DIE CASTING DIRECTORY

PMM

Precision Metal Molding

JANUARY
1957

INCLUDING DIE CASTINGS MAGAZINE

devoted exclusively to:

DIE CASTINGS

INVESTMENT CASTINGS

PERMANENT MOLD CASTINGS

PLASTER MOLD CASTINGS

POWDER METALLURGY

SHELL MOLD CASTINGS

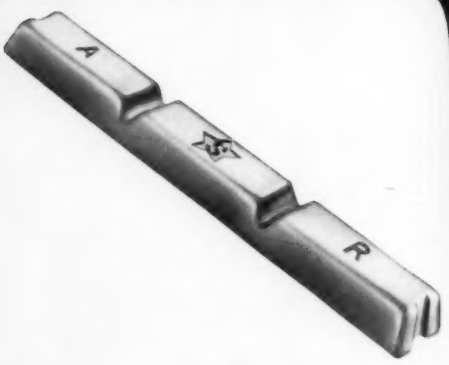
"Most of our die castings must be pressure-tight . . ."

David H. Thorburn
Chief Engineer
Powers Regulator Co.

See Page 3

Aluminum and Zamak

In All Standard Or Special Aluminum And Zinc Based Die Casting Alloys



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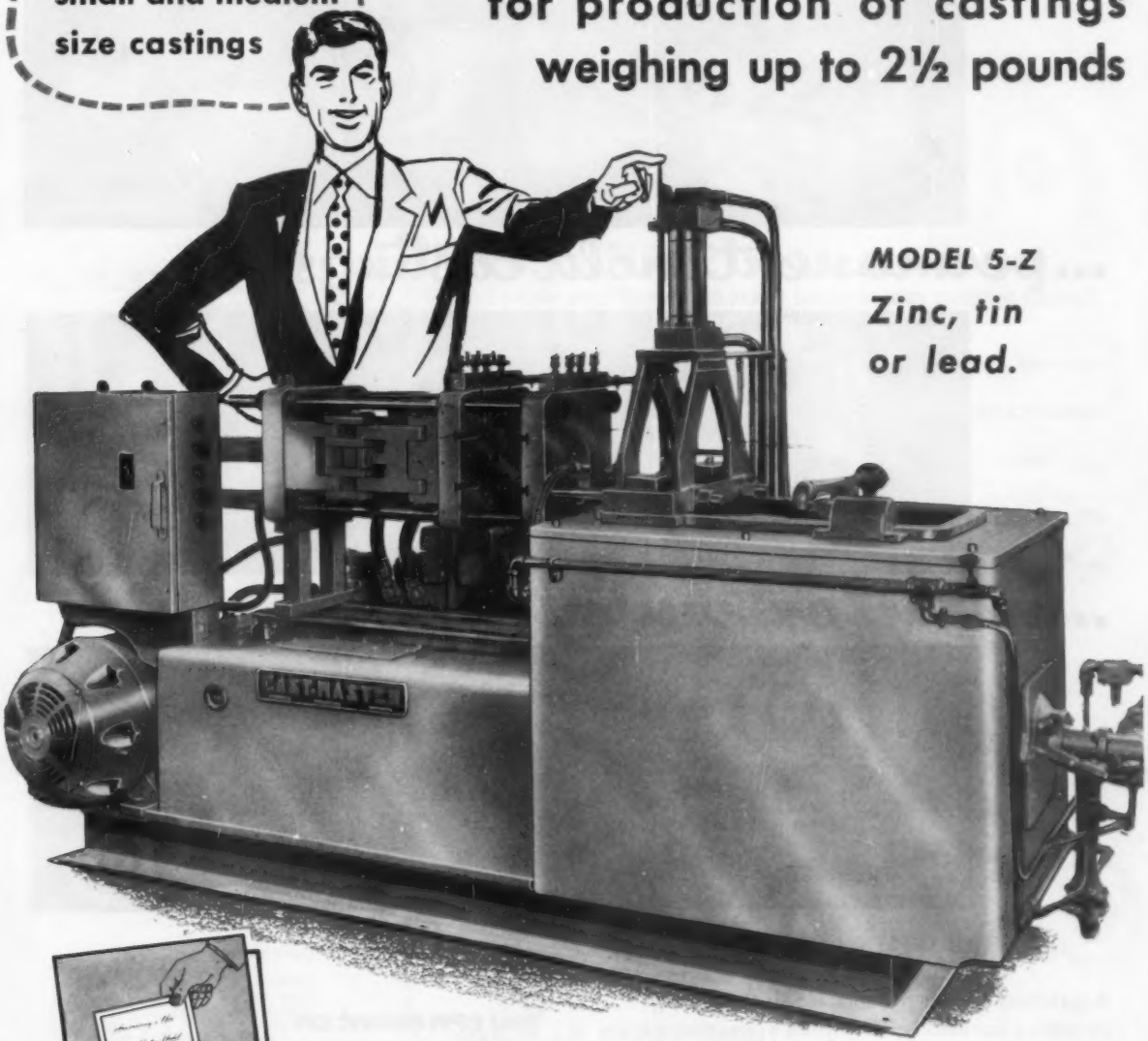
The MIGHTY MIDGET

for production of castings weighing up to 2½ pounds



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Zinc, tin or lead.

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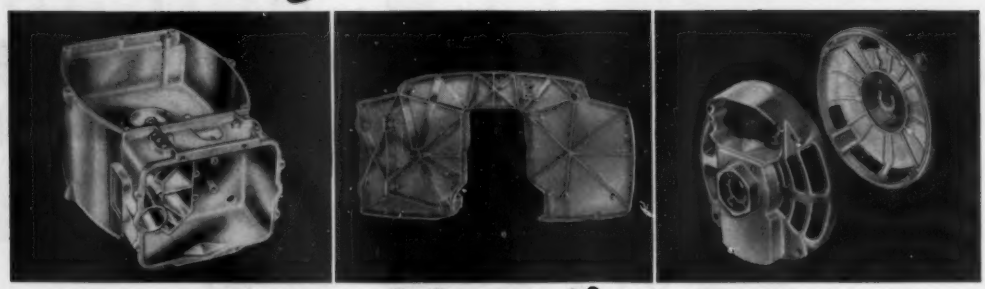
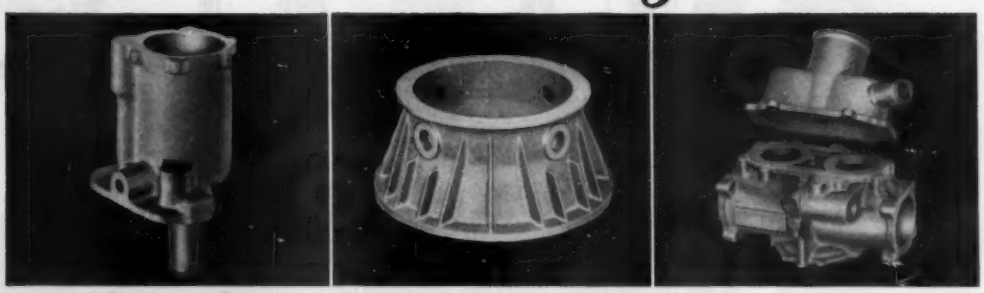
for die castings



...permanent mold castings



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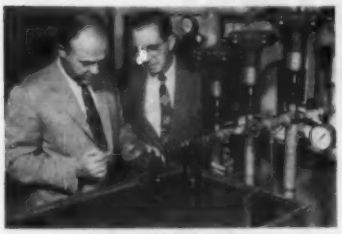
COVER STORY



FOR PRESSURE APPLICATIONS, these die castings must be non-porous. D. H. Thorburn (r), chief engineer, and C. H. Preisemeyer, project engineer, Powers Regulator Co., check some valves using such die castings. See page 52.

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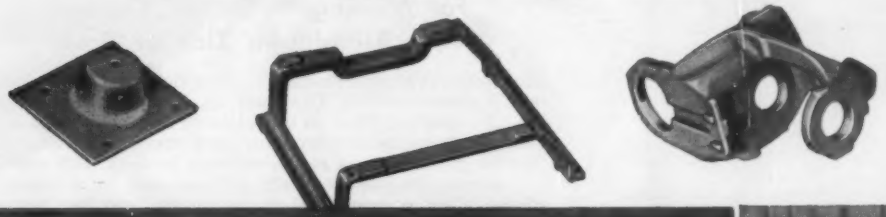

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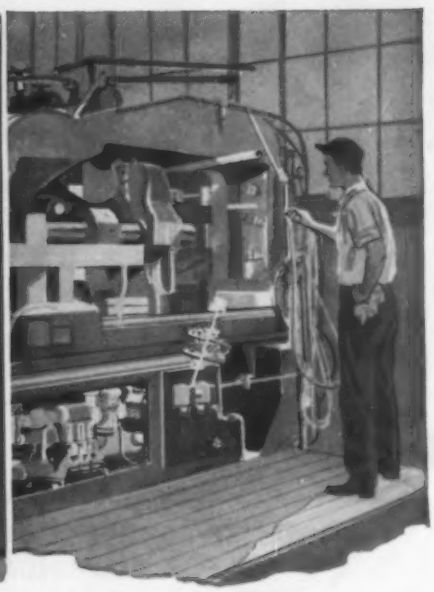

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Plaster	V	V
Shell Mold	V	V
Die	V	V
Permanent Mold	V	V

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For Melting Unlimited Capacities of Aluminum, Zinc or Brass

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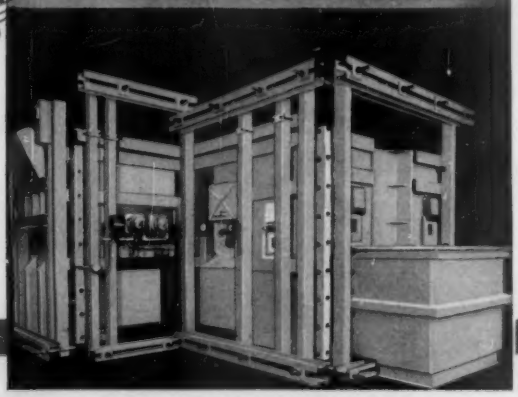
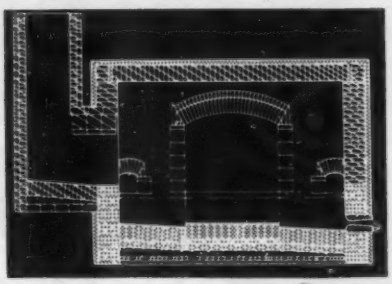
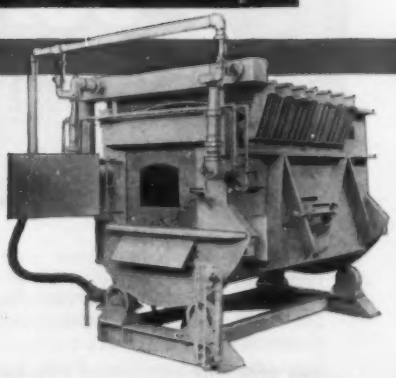


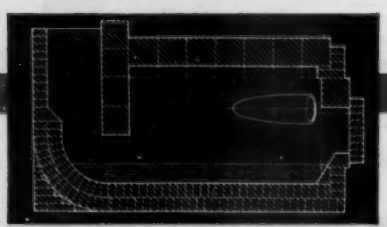


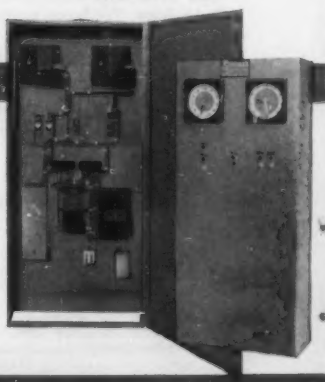
STROMAN TYPE "SW" CRADLE TILTING FURNACE FOR ALUMINUM MELTING SIZES FROM 1,000 TO 3,000 POUNDS

An ideal furnace for breakdown to supply hot metal to holding furnaces for die casting or permanent mold. Also for distribution to the molding floor in sand casting foundries. Tilted by means of an air or hydraulic ram. Furnished complete with gas or oil burners or combination burners, blower to furnish combustion air, and lining made of standard fire brick shapes.



Automatic temperature and safety controls available if desired.





STROMAN CUBICLE TYPE CONTROL PANEL

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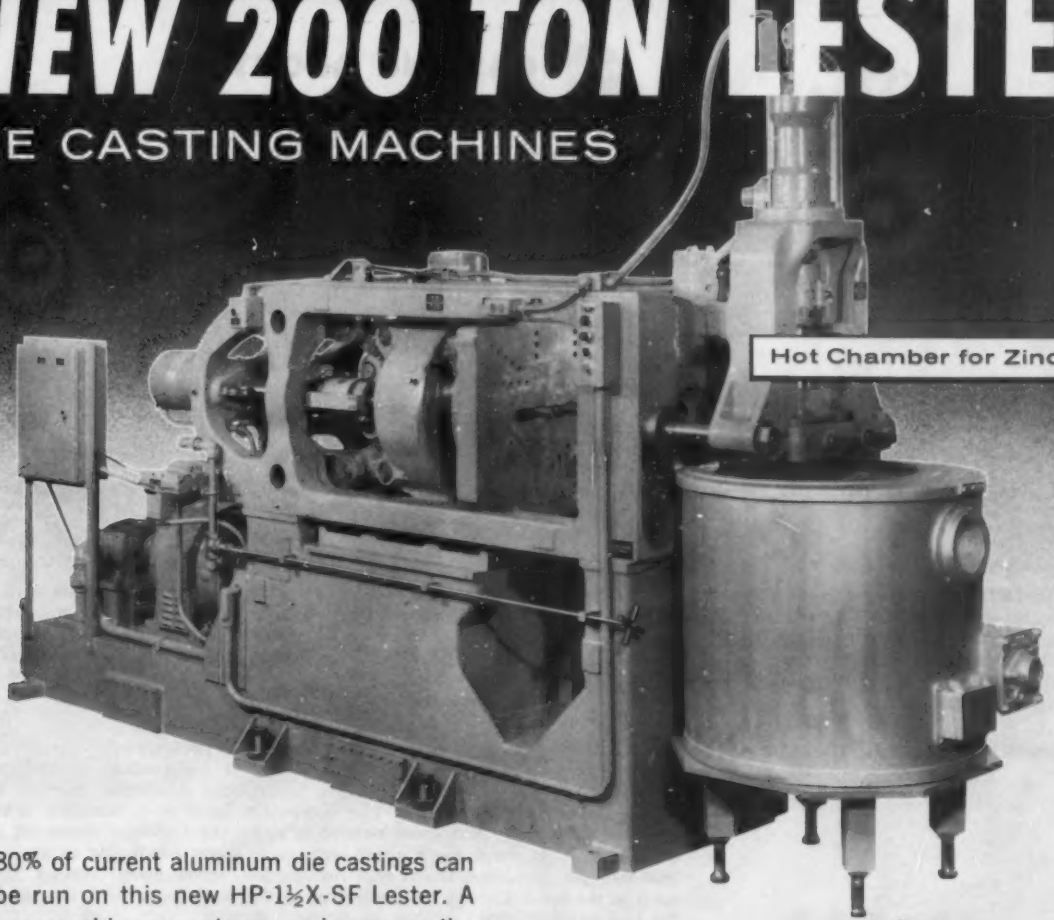

Hot Chamber for Zinc

80% of current aluminum die castings can be run on this new HP-1½X-SF Lester. A comparable percentage can be run on the zinc counterpart, the HP-1½Z-SF. Die movement has been increased from 8″ to 10″ for deeper draw castings. Horizontal clearance between the beams has been enlarged from 14″ to 17″, giving 21% more access for lowering large dies through the top of the frame. Strain gage testing has shown that the new frame and toggle design locks the machine at considerably more than its rated tonnage. Here is the machine that fills a vital need in the die casting industry.

Cold Chamber for Aluminum

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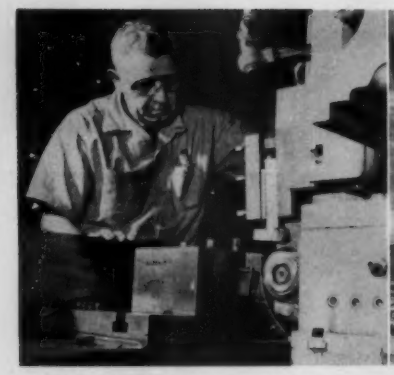
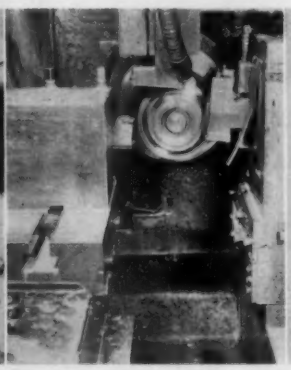
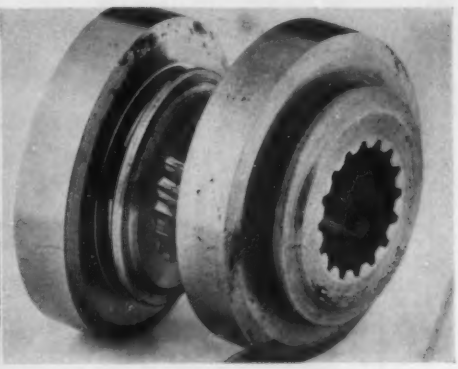
PMM CASTING ABOUT

technical news of applications & processes involving precision metal moldings







CEMENTED OXIDE cutting tools are combined with carbides on this Sundstrand automatic lathe for finish machining gears. As many as 3,000 pieces per corner are produced with these tools.

TOOLING INCLUDES CARBIDES where ceramics are not applicable. The grooving tool, for example, is too narrow to be clamped. Drag in return stroke of the facing tool would impair a ceramic tool.

BETTER SURFACE FINISH with consistent readings of 85 rms are reported coming from ceramic tools. Sliding gear, left, was machined with cemented oxide tools at 1000 fpm; carbide for other gear at 450 fpm.

CEMENTED OXIDE CUTTING TOOLS used at Ford Motor Company's Dearborn plant have reduced tool changes, slashed cycle times, increased machine speeds, shifted one machine to other work, in machining forged 5153 steel gears. Operations performed include finish turning, grooving and facing. The automatic lathe is a standard machine modified for rigidity and speed needed to apply the Carboloy cemented oxide 0-30 tools. Tools are changed every eight to 16 hours, producing an average of 1600 cuts per tool edge. Insert type holders for "throw away" cutting tips are used on the lathe. Cutting tools converge on the work from front, top and back. No coolants are used.

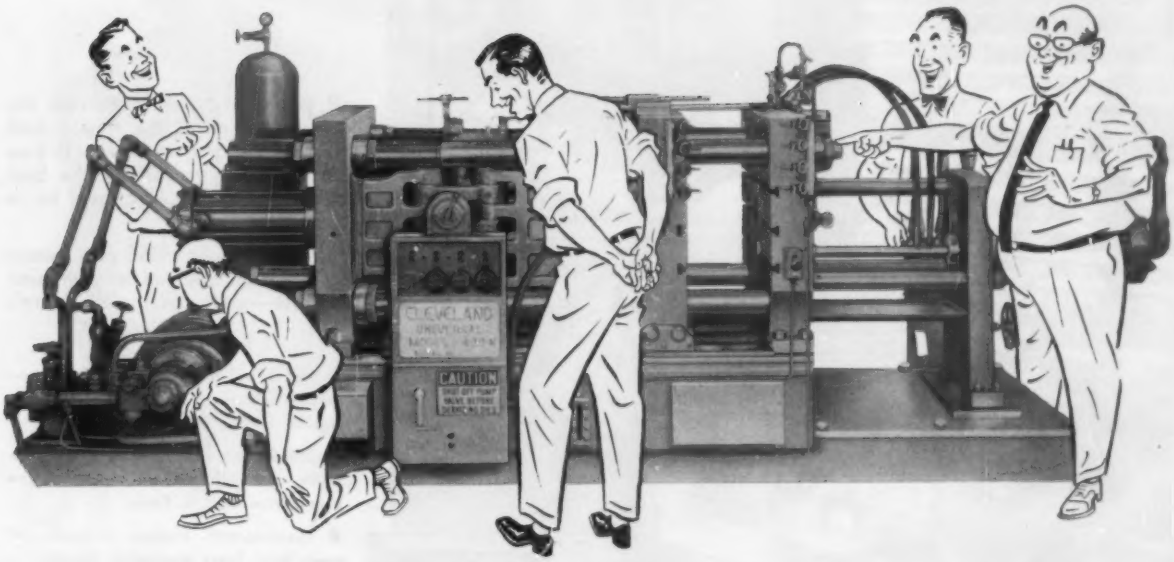
MORE VACUUM MELTING CAPACITY is being installed currently to meet industry's need for high performance metals. *Investment castings:* At Austenal, Inc., a number of vacuum furnaces specially designed for investment casting are being installed by F. J. Stokes, who designed and built them. Early 1957 is the scheduled date of completion. *Molybdenum:* A new 12-inch furnace built by General Electric is going into Universal Cyclops Steel plant at Bridgeville, Pa., for production melting of molybdenum and its alloys. It handles ingot from 850 to 5000 pounds. *Titanium ingot:* Construction of new, larger vacuum arc-melting furnaces for production of titanium ingots by Electro Metallurgical Co., division of UCC, has been announced. Objective . . . to help in the conversion of the increased output of titanium sponge into mill products.

COOPERATIVE PROMOTIONAL EFFORT by European investment casters took the form of a jointly sponsored exhibit at the International Foundry Trade Fair in Dusseldorf this past Fall. From nine countries, 28 investment casting foundries pooled their wares. Information, education and influence of designers were objectives. In U. S., other branches of the foundry industry have undertaken this type of display. Example: the American Die Casting Institute, association of jobbing die casters, who have exhibited widely. However, American investment casters have not yet put together this type of exhibition, although the Investment Casting Institute has initiated and completed a large number of other cooperative programs to accomplish similar purposes. At the European exhibition, a wide variety of castings was displayed, and the response of visitors to the display has been described by Americans who attended as "most impressive."

Continued on page 12

WELL WORTH LOOKING INTO!

Cleveland Model 400-N shown with cold chamber end. Weight of metal per shot, including gate: 7.2 lbs., aluminum; 14.5 lbs., zinc.



New CLEVELAND model 400-N

Hydraulic Universal Die Casting Machine

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Here is a massively constructed, rugged, powerful machine. It locks dies at better than 400 tons pressure, *strain gauge tested*. Its faster die closing and opening speed will give you more shots per hour. Its rapid injection speed guarantees production of sound, dense, hardware-finish castings. Further, Cleveland's time-tested design and quality construction assure dependable, around-the-clock operation with machine maintenance at a minimum level.

Look into the new Cleveland Model 400-N, from every angle. You'll quickly discover why leading die casters call it the outstanding machine buy in its capacity range. Call in a Cleveland sales engineer for complete information and send for the new Model 400-N Bulletin.

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- HB&S laboratory control guards the purity and uniformity of all ingots you order, from start to finish.
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- An identifying number is marked on every 2,000 lb. pallet of hot bars as they come off the conveyors. The heat number is on every ingot. You know exactly what you're getting.
- Alloy bars are shipped to you on consumable skids at no extra charge.
- You pay no more for HB&S quality — or quality control.

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- **"Die Casting with Zinc Alloys."** Technical guide for plant managers and die casting machine operators. Explains all factors that influence production of sound castings with good surface finish. (Booklet is available in quantities.)
- **17" x 22" Wall Chart of Standard Brass, Bronze & Nickel Silver Casting Alloys.** Saves engineers and designers hours of time in making up specs. Detailed information on 37 alloys, their Navy, S.A.E., A.S.T.M. and Federal specifications, chemical composition by percent of ingredients.

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Smelters and refiners of aluminum, bronze, brass, zinc, lead

"Dependable Service Since 1922."

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Practiced, Practical Die Designing

with MADISON-KIPP zinc and aluminum die castings

The complex "flying machine" type of dies are sometimes necessary to accomplish an urgent end result. The practical, the practiced die designer will, however, help you equate the advantages and disadvantages of castings requiring complicated tooling. Two simpler fabricated die castings may not be so ingenious as one, but they may offer economies.

The mechanical skill at Madison-Kipp has been utilized by highly placed designers and engineers for over a quarter century. They will be glad to try to help you on your next die casting program.

Please clip this ad as a reminder to contact us when you have die casting requirements.

kipp

MADISON-KIPP CORPORATION
213 WAUBESA STREET • MADISON 10, WIS., U.S.A.

Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

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2 easy ways to make your MOLD STEEL pay!

1. *Send for the Heppenstall Bulletin on MOLDTEM.* It will provide you with information regarding the dependable, uniform quality that will save time and money—when you specify Heppenstall's Mold Steels. It also provides specifications and availability of stocks.

2. *Specify Heppenstall MOLDTEM.* You will save time and money because you will obtain Mold Steels with advantages like these:
   a. Superior machinability
   b. Uniformity of hardness
   c. Exceptional polishing characteristics
   d. Resistance to high pressures
   e. Savings in finishing time

Write or telephone today

HEPPENSTALL

most dependable name in **DIE STEELS**

Pittsburgh 1, Pennsylvania

Sales offices in principal cities

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CASTING ABOUT

continued from page 8

CUTTING STICKS, made up of crushed bits of sintered tungsten carbide held in a nickel-bronze matrix, is one of the newer uses of the products of powder metallurgy. The multitude of jagged cutting edges of the carbide particles are exposed as cutting edges as the nickel-bronze matrix wears away, giving a long-lasting rod of cutting material. Principal use of the material, called Sintercut, is in the oil fields. Manufacturer is Diamond Metal Company.

STAINLESS WHALES have been awarded to six members of the Investment Casting Institute for doing a "whale of a job." The awards, made at the Institute's recent annual meeting, went to Kenneth M. Bartlett, executive VP of Horizons, Inc.; Ted Operhall, president of Misco Precision Castings Co.; Dr. Nicholas J. Grant of Massachusetts Institute of Technology; Roger Waindle, president of WaiMet Alloys Co.; Edward G. Chapman of Misco; and Dr. Richard A. Flinn of the University of Michigan. The miniature leviathons are cast in 303 stainless and mounted on rosewood blocks.

Waindle Grant Operhall Bartlett

NAMEPLATES AND EMBLEMS, whether designed as solid plates or cut-out lettering, can be effectively produced as die castings. Possibilities suggested to the designer along these lines include: complex contours, clean legibility, good finishability, ease of assembly. For this consideration, studs, shanks or bosses can be cast in place, cored holes can be provided, and threaded inserts can be cast in place. Special types of fasteners have been developed to simplify and speed the assembly of die castings. The trend toward use of die castings for nameplates, emblems and insignia is illustrated by this photo from the American Die Casting Institute.

Continued on page 14

"To Err is Human..."

GUSTAV NYSELIUS
President
43 years

LEWIS HELD
Vice President
21 years

THOMAS J. WALKER
Controller & Secretary
21 years

HANS HANSON
Die Room Supervisor
40 years

VINCENT SARACCO
Eng. Asst. to V. P.
15 years

GEORGE NEWBERG
Tool Room Supervisor
32 years

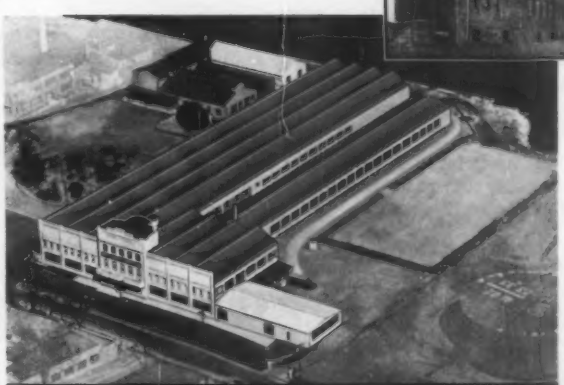
– but when we've made mistakes at Mt. Vernon, it's the customer who benefits

If there lives a man who has never made a mistake—it's because he has never had the courage to try anything new.

The 6 men pictured here are the men to whom you entrust your work when you hire Mt. Vernon to do it. The total of their experience in die casting adds up to 172 years.

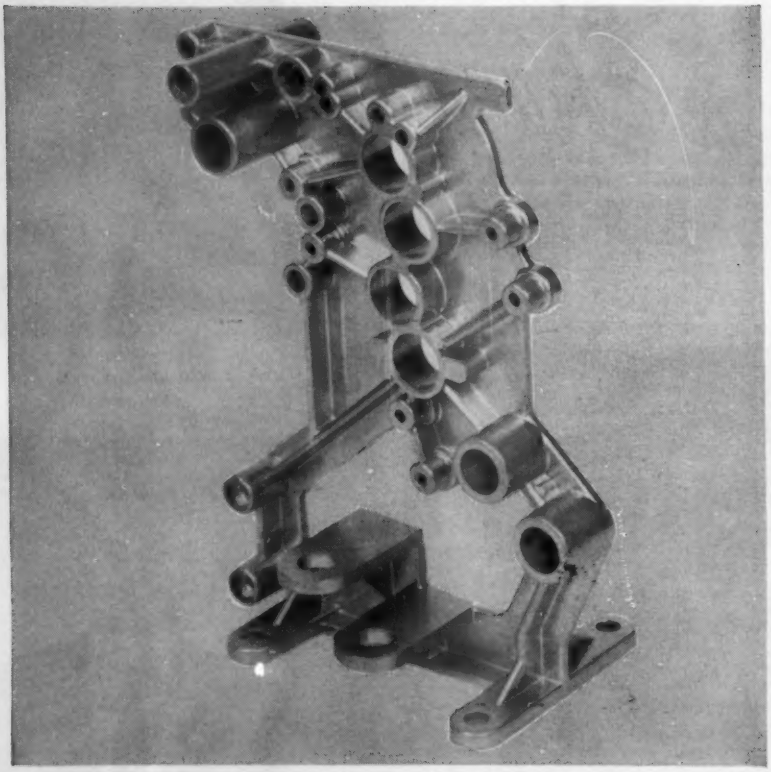
Each of them is exceedingly human—and each of them would be the first to admit that he has made some mistakes. But in doing so, he has learned better ways of giving you ever finer die casting, at ever lower cost to you.

It is these men's perpetual discontent with doing things the accepted way, the "good-enough" way, that has gained for Mt. Vernon the enviable name that we have today. It is because they *have* made some mistakes—and because *you* have profited by them—that the firm which in 1905 started in a modest 2 story building (inset) has grown into this complete and completely modern die casting plant occupying 200,000 square feet.



MT. VERNON
DIE CASTING CORP.
STAMFORD, CONNECTICUT

For more information circle No. 80 on the Reader Service Card



What other process could do it so well?

All things considered, there's really only one *best* way to produce this typical die casting application.

When you figure that it must be built at the lowest possible unit cost, must use a production method that is highly flexible to accommodate the unusual shape, and must maintain a variety of close tolerances . . . only die casting *could* do the job.

Working closely with Twin City engineers, this manufacturer *designed* for die casting to get the maximum out of the process. By thinking in terms of die casting right from the drawing boards he eliminated many production and finishing jobs, saved on unit costs, saved on machining.

Possibly you're producing a part by some more costly, less flexible, less accurate process than die casting. If you think that might be true, contact Twin City Die Castings Company. Twin City engineers can probably save you money. They have for hundreds of customers.

...only DIE CASTING can

✓ cut your costs

✓ offer such flexibility

✓ provide such accuracy

FOR PROOF... CALL, WRITE OR WIRE:

TWIN CITY DIE CASTINGS CO.

3351 TALMAGE AVENUE S. E. • MINNEAPOLIS 14, MINNESOTA

TELEPHONE MIDWAY 6-7528

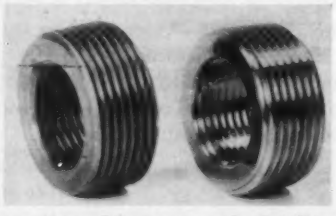
For more information circle No. 108 on the Reader Service Card

CASTING ABOUT

continued from page 12

NEW TOUGH COATINGS. What can they do for your product? **For aluminum:** A wear-resistant coat of steel sprayed on aluminum cylinder walls opens up new possibilities for designers of engines or comparable products. Alcoa, working with Metallizing Engineering Company, has come up with a paper-thin alloy-steel coating on aluminum that is described as removing a major roadblock in the development of America's first practical all-aluminum engine. Says Alcoa, "The need for special slotted pistons, or pistons fitted with expansion control devices, will probably be as outmoded as the carriage tire. **For titanium:** The National Bureau of Standards has successfully electroplated hard, adherent, protective coatings on titanium. The procedure involves forming a titanium fluoride film on the metal surface, electroplating with chromium, and heat treating at 800 C. **For aircraft engine alloys:** Refractory type ceramic coatings developed for use on metal parts exposed to high temperatures, as in aircraft engines, have been studied by the NBS to determine creep behavior under different temperature conditions. Their findings . . . under some conditions, these coatings can reduce creep rate as much as 50 percent. Since creep characteristics can limit the useful life of metals, these coatings are considered to have great practical importance.

AWARD WINNER in a barrel finishing contest sponsored by Almco Supersheen is Canadian Pratt and Whitney Aircraft Company, Ltd., of Montreal, for saving 97 percent over



previous deburring and finishing costs. Basis for the award is a $2,430 annual saving on the finishing of spark plug bushings used in aircraft engines. Quality gains are also cited: non-uniformity of manually finished bushings accounted for a 12½ percent reject rate. Elimination of rejects is now reported.

BLADE SHAPES are the subject of a report of Air Force research just released by Office of Technical Services, U. S. Dept. of Commerce. Means of prescribing blade shapes to give the desired flow distributions in axial-flow turbomachinery. It is available from OTS in Washington for 50 cents.

Betty — the Martin girl says

Martin solves production bottlenecks...

MARTIN

gets specified die-cast components to you in quickest possible time!

Whatever the size of your order, there s no waste time or motion at Martin. Why? Because each year our Cost Analysis Engineers spend hundreds of man-hours further streamlining our already-streamlined production facilities. This means quick-as-a-wink service for YOU. Streamlining production not only means faster delivery, but lower costs, which are immediately passed on to you.

And . . . "one roof responsibility" plus the most modern equipment made mean you get the *best*—whether you order one part or one-hundred. We meet your *exact* needs to micro-dimensional tolerances. From drawing board to finished product, our integrated facilities and skilled craftsmen with 5,000 years of cumulative experience are *at your complete disposal.*

Shown above are representative sleeves which we produce

We believe we have the finest facilities in the industry for manufacturing such precision die-casting components as: COLD SHOT SLEEVES . . . ADAPTER BUSHINGS . . . FEED CHAMBERS . . . PLUNGER TIPS . . . AND GOOSENECK SLEEVES.

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DATA OFFERED IN THIS MONTH'S ADS

the Reader Service Cards on the facing page will get you these free reference materials. Circle the numbers and mail.

1. **1,000 Shots Per Hour**—according to bulletin A-10, an engineering report on small die casting machines from ABC Die Casting Machine Co.

2. **Colloidal Dispersions**—Bulletin 425 from Acheson Colloids Co. describes the different lubricants available for castings use.

5. **Alloy Metal Powders**—The use of these powders in the fabrication of parts, and the properties of these parts, are covered in detailed reports from Alloy Metal Powders, Inc.

6. **From Drawing**—to finished casting or finished assembly is the service offered by Tri-State Die Casting Corp. A complete catalog of services, facilities, etc. is available.

7. **Low Cost, High Speed**—die casting machines are described and all of the specifications given in an illustrated folder from the American Die Casting Machinery Co.

8. **Zinc Alloys**—Full Information on zinc-base alloys is available from the Metal Sales Dept. of The American Metal Co., Ltd.

18. **13 Models**—of die casting machines are described in bulletins from B&T Machinery Co. Machines range in capacity from 100 to 750 tons—for zinc, aluminum, and brass.

20. **Aluminum, Magnesium**—castings by five processes are described in a 24-page booklet offered by Bendix Foundries. Advantages of each type of casting in these alloys are covered.

23. **"Diecasting Small Parts"**—is the title of a 24-page book published by British Industries Corp. explaining the entire process and the DCMT packaged die-casting shop.

25. **Complete Alloy Service** — and technical data on special, rare, and vacuum-melted alloys is offered in a new bulletin from Cannon-Muskegon Corp.

28. **Entirely New** — Universal die casting machines are described in model 400-N bulletin from The Cleveland Automatic Machine Co.

32. **Safety Hydraulic Fluids**—New grades of Ucon Hydrolubes are discussed in a booklet published by Carbide & Carbon Chemicals Co., "Ucon Hydrolubes Spell Safety," Form 40134.

33. **Bronze Bearings**—All standard sizes—over 1,000 sleeve, flange and thrust bearings, cored, bar and plate stock—are listed in a bronze bearing stock list published by Amplex Div., Chrysler Corp.

40. **Sprue Bushings & Spreaders**—Complete specification sheets giving all the uses and advantages of specially designed sprue spreaders are available from Detroit Mold Engineering Co.

46. **Aluminum Alloy Treatment**—Leaflets are available from Foundry Services Inc. discussing the treatment of aluminum alloys. The elimination of gassy and oxidized metal and metallic drosses is covered.

47. **Die Casting Lubricants**—A bulletin is available from Fiske Bros. Refining Co. on die lubricants for aluminum die casting. Literature is also offered on lubricants available for other aluminum working processes.

53. **Services and Products** — of Gries Reproducer Corp. are discussed in five bulletins: "Small Parts Diecasting," "Small Parts Plastic Molding," "Industrial Fasteners," "Stock Sheet—Gear and Pinions," and "Standard Products."

55. **Aluminum Die Castings**—A brochure has been published by Hampden Brass & Aluminum Co. that gives details about the experience, facilities, and equipment of the company.

56. **Fluxes for Aluminum or Zinc**—A technical bulletin giving important information on fluxing procedures and improved shop practice has been issued by Haviland Products Co.

57. **Reference Guides**—Three publications are offered this month from Henning Bros. & Smith, Inc.: "Henning Zamk Base Die Casting Alloys," covering the mechanical and physical properties of the alloys; "Die Casting with Zinc Alloys," explaining all factors that influence the production of good castings, and a 17 by 22-inch wall chart of standard brass, bronze, and nickel silver casting alloys.

58. **Mold Steel**—A bulletin issued by Heppenstall Co. describes the time and money saving advantages, specifications, and stock availability of their line of mold steels.

59. **Proper Metal Selection**—Bulletin 116-205 issued by Hitchner Mfg. Co. tells how the right metal selection for investment castings can often increase efficiency and reduce costs.

61. **Die Casting Machines**—Complete information is now available from The Hydraulic Press Mfg. Co. on their new line of die casting machines. Eight sizes from 200 to 1500 tons are available.

66. **Fast Production**—Bulletin 1956 offered by Johnson Machine & Press Corp. describes the company's line of presses designed to give faster and better production.

72. **Aluminum, Magnesium Die Castings**—Literature and design information is available from Litemetal Dicast, Inc. describing the advantages and production of aluminum and magnesium die castings.

78. **Die Lubricants**—A new Di-Alube brochure has been published by Milwaukee Metalube Co. describing the company's die lubricants. These lubricants have been specifically formulated for use in die casting.

85. **"How and When to Hob"**—is the title of a booklet published by Newark Die Hobbing & Casting Co.

94. **Iron Powders**—Complete information on all of Republic Steel's three new grades of iron powder is given in booklet Adv. 763. Included is a description of the powders' "CDF" feature.

98. **Stainless Steel Ladles**—and skimmers for non-ferrous metals are listed in data from Spincraft, Inc. Sizes in stock and prices are also included.

99. **Presses for Metal Powders**—A series of three bulletins has been issued by the F. J. Stokes Corp., "Powder Metallurgy Today," catalog No. 801 on powder metal presses and bulletin No. 670 on model 640 press.

103. **Melt Any Metal**—A complete catalog is offered by the Stroman Furnace & Engineering Co. describing Stroman's line of furnaces for the melting of brass, bronze, aluminum, magnesium, grey iron, and all other metals in any size.

Continued on page 18

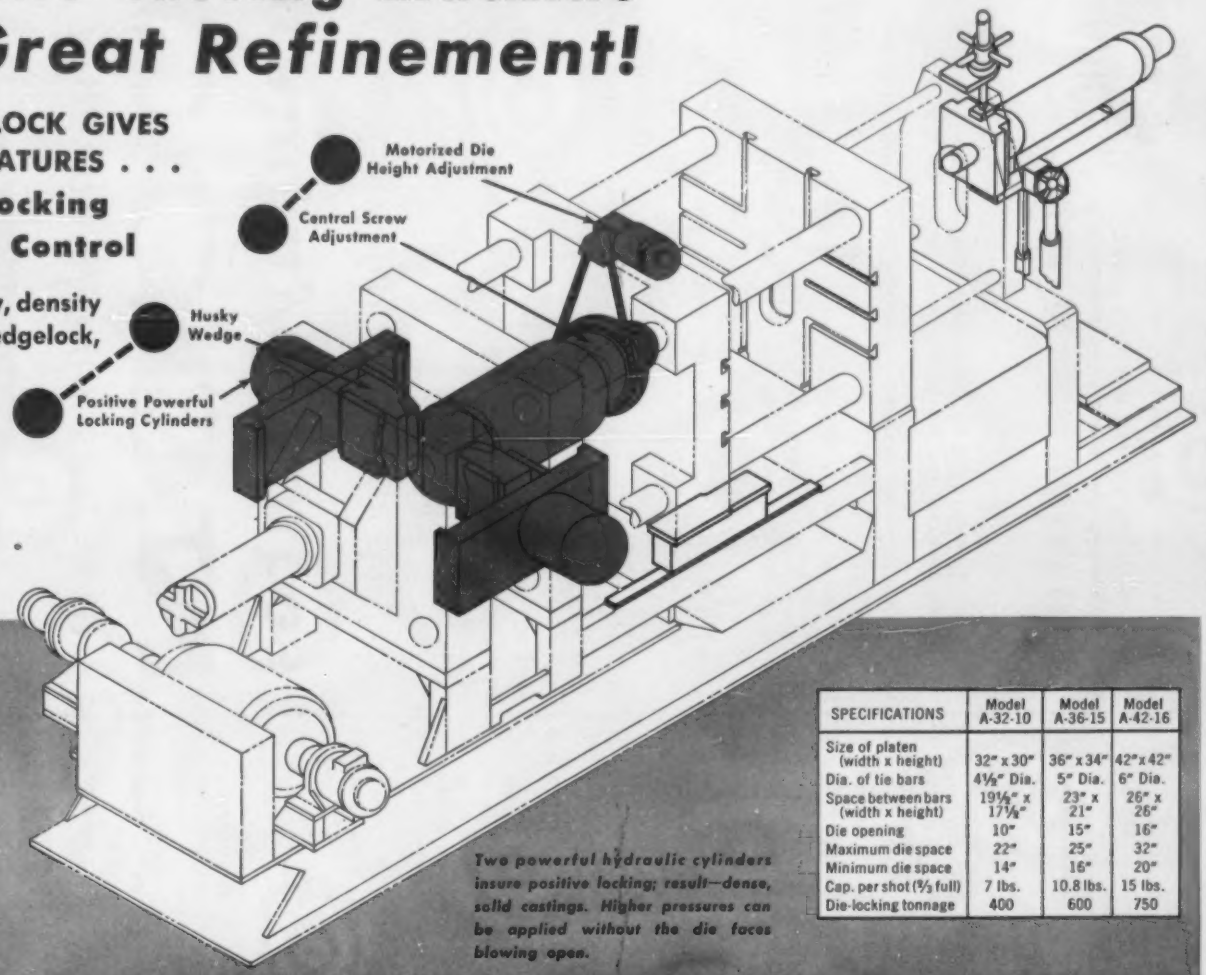
WEDGELOCK

– the die casting machine of *Great Refinement!*

ONLY WEDGELOCK GIVES YOU THESE FEATURES . . .

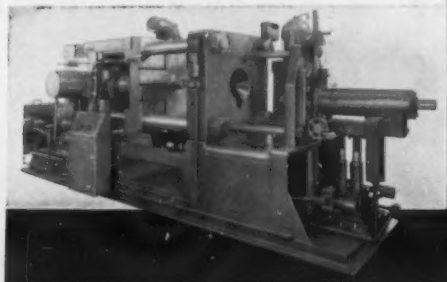
- **Positive Locking**
- **Finger-tip Control**

For the ultimate in die casting uniformity, density and usable production, investigate Wedgelock, now in its twelfth year. Safe pressures in the shot plunger range up to 40,000 lbs. Die adjustments are easily made to .001". Central hydraulic ejection speeds operation. Other major features. Ask on your letterhead for complete bulletin.



Two powerful hydraulic cylinders insure positive locking; result—dense, solid castings. Higher pressures can be applied without the die faces blowing open.

SPECIFICATIONS	Model A-32-10	Model A-36-15	Model A-42-16
Size of platen (width x height)	32" x 30"	36" x 34"	42" x 42"
Dia. of tie bars	4½" Dia.	5" Dia.	6" Dia.
Space between bars (width x height)	19½" x 17½"	23" x 21"	26" x 26"
Die opening	10"	15"	16"
Maximum die space	22"	25"	32"
Minimum die space	14"	16"	20"
Cap. per shot (⅔ full)	7 lbs.	10.8 lbs.	15 lbs.
Die-locking tonnage	400	600	750



CUYAHOGA INDUSTRIES, INC. 17920 WATERLOO ROAD CLEVELAND 19, OHIO

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why you should switch to

UCON

brand hydrolubes

Carbide's Safety hydraulic fluids

1) The *fire-resistance* of water-base Ucon Hydrolubes has been proved by years of severe, exhaustive laboratory tests. In actual service, Ucon hydrolubes have prevented serious fires and injuries during more than eight years of routine use.

2) Ucon Hydrolubes have *no harmful effects* on packings and seals. Leakage losses are often lower than with other hydraulic fluids.

3) Ucon Hydrolubes can be *safely handled* by workmen.

4) Ucon Hydrolubes are made in *three standard viscosity grades*—200, 300, and 550 S.U.S. at 100°F. Other grades can be supplied to fit specific needs.

5) Ucon Hydrolubes have *high viscosity indexes*—150 to 160.

6) Ucon Hydrolubes are *good lubricants*. Special anti-wear agents provide satisfactory pump life and performance characteristics.

7) Ucon Hydrolubes contain effective liquid and vapor phase *corrosion inhibitors* for the common metals.

8) Ucon Hydrolubes have *low pour points*—a must for use at low temperatures.

Ucon Hydrolubes are the answer to the problem of improved safety with hydraulic fluids. Get all the facts. Write *today* for the booklet "Ucon Hydrolubes Spell Safety," Form 40134.

CARBIDE AND CARBON CHEMICALS

CARBIDE AND CARBON CHEMICALS COMPANY

A Division of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York 17, New York

The term "Ucon" is a registered trade-mark of Union Carbide and Carbon Corporation.

For more information circle No. 32 on the Reader Service Card

DATA IN ADS

continued from page 16

110. Finishing Non-Ferrous Metals—The application of Iridite chromate conversion finishes to non-ferrous metals is discussed in literature available from Allied Research Products, Inc.

111. Drilling, Tapping Machinery—A catalog is available describing Ettco Tool & Machine Co., Inc.'s complete line of drilling and tapping equipment.

112. Brush Polishing Head—Bulletin 102 from Grinding & Polishing Machinery Corp. describes the "Vonnegut 32" brush polishing head, now available in one inch abrasive face width to get inside the most intricate patterns.

114. Abrasive Belt Machines—A catalog on abrasive belt machines, claimed to offer grinding, polishing, and deburring economy, can be obtained by enclosing your company letterhead with the advertisement from Hammond Machinery Builders, Inc.

116. Strip Paint Problems—If tough finishes resist present stripping methods, Oakite Products, Inc. offers helpful information in two booklets: "How to Strip Paint," and "Here's the Best Shortcut in the Field of Organic Finishing."

117. Deburring, Surface Finishing—and other metal removal and surface improvement operations can be done with blast cleaning. This type of equipment is described in bulletin 1403 from Pangborn Corp.

120. Die Assemblies—Complete specifications and prices on time-saving die assemblies using standard cavity retainer sets and ejector boxes are available from Detroit Mold Engineering Co.

17. Die Steel—A concise four-page folder is offered by Allegheny Ludlum Steel Corp. giving handling and shop treatment details on "Potomac M," hot-work die steel.

19. Spectrographic Laboratory—Complete technical information is available from Baird-Atomic, Inc. on their line of spectrographic laboratory equipment.

Continued on page 20

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- ☐ Investment Castings
- ☐ Powder Metal Parts
- ☐ Permanent Mold Castings
- ☐ Plaster Mold Castings
- ☐ Shell Mold Castings
- ☐ None of these

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Street .....

City ..... *Zone* ..... *State* .....

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1	18	35	52	69	86	103	120	137	154	171	188	205	222	23v	256	273	290
2	19	36	53	70	87	104	121	138	155	172	189	206	223	240	257	274	291
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4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306

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3	20	37	54	71	88	105	122	139	156	173	190	207	224	241	258	275	292
4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306

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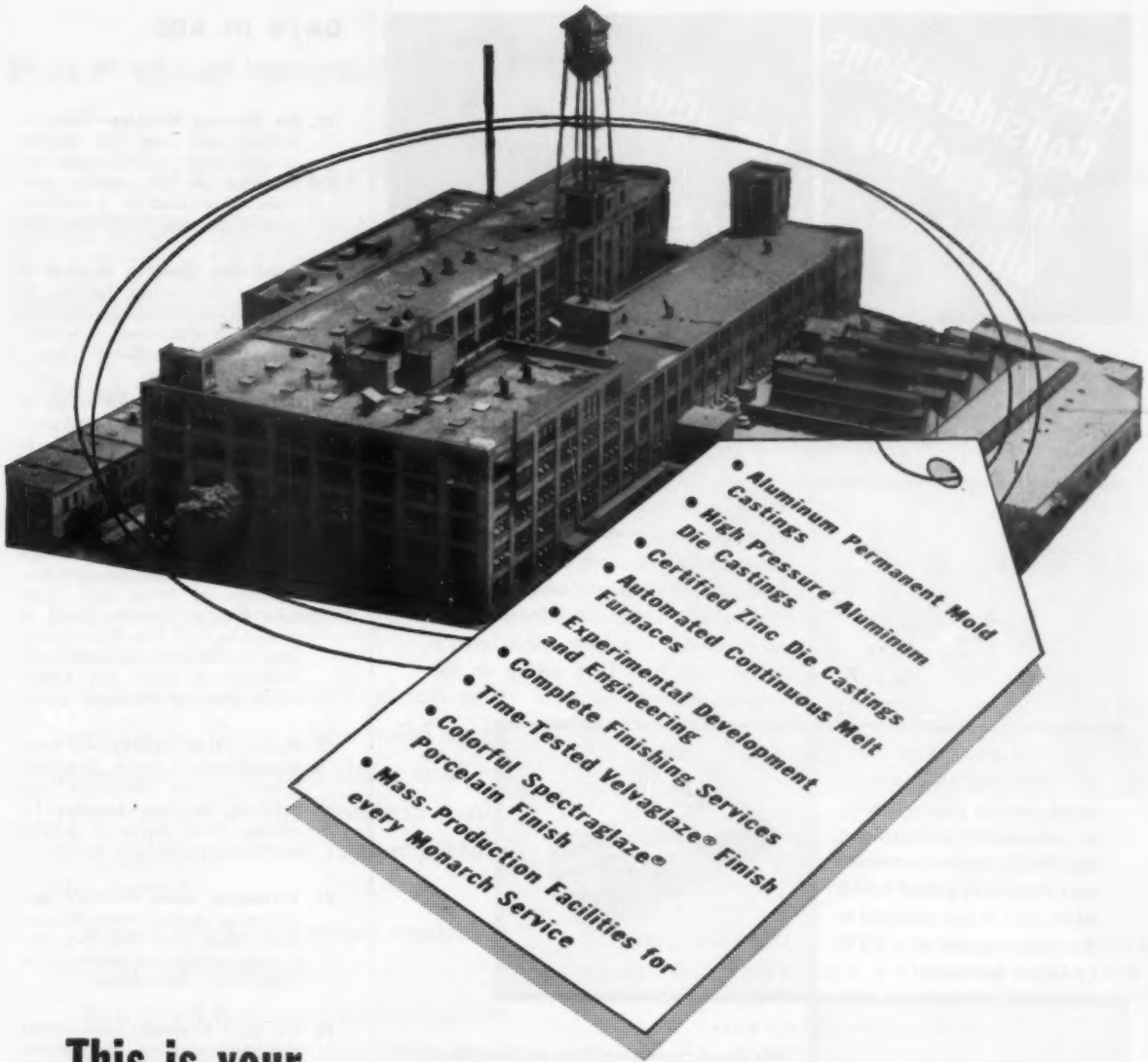

• Aluminum Permanent Mold Castings
• High Pressure Aluminum Die Castings
• Certified Zinc Die Castings
• Automated Continuous Melt Furnaces
• Experimental Development and Engineering
• Complete Finishing Services
• Time-Tested Velvaglaze® Finish
• Colorful Spectraglaze® Porcelain Finish
• Mass-Production Facilities for every Monarch Service

This is your
COMPLETE PRODUCTION PACKAGE
for more casting value per dollar

Monarch offers you *more* than just castings. Here at one source, with one responsibility, you have available totally integrated, complete Mass-production services. These services are geared to your manufacturing requirements—from rough casting to finished component. Unique casting and finishing innovations, developed by Monarch, broaden your range of casting design. Come to Monarch to get factual "Non-competitive" answers for improving your end-product performance at lower end-cost.

SINCE 1913
MONARCH
ALUMINUM
PIONEERS IN CASTING PROGRESS

•Velvaglaze and Spectraglaze are Trade Marks of

MONARCH ALUMINUM MFG. COMPANY—9205 DETROIT AVENUE—CLEVELAND 2, OHIO—OLympic 1-1700

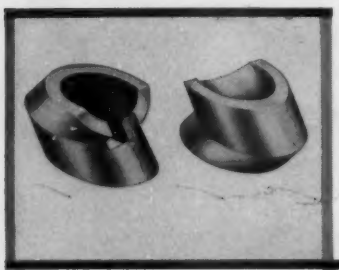
MANUFACTURERS OF: *Aluminum Permanent Mold Castings • Zinc Die Castings • Aluminum Die Castings • Exclusive Velvaglaze Finishing • and Spectraglaze, colorful Porcelain Enamel on Aluminum Permanent Mold Castings.*

For more information circle No. 79 on the Reader Service Card

Basic Considerations in Selecting alloys . . . . for your

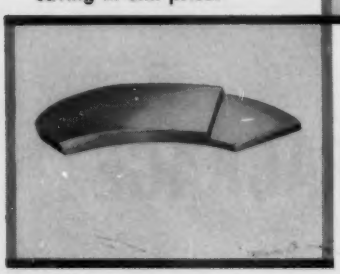
INVESTMENT CASTINGS

DO YOU KNOW THAT . . . an investment casting produced from a low cost metal may be MORE EXPENSIVE than one cast from higher priced material that may also have characteristics better suited to your requirements.



These angle connectors were originally investment cast in mild steel, a low cost material. To overcome corrosion problems, 303 stainless was substituted and because of its better castibility there was no increase in cost. Now, silicon brass is being used at a 10% saving on the original selling price.

This gage mount is an excellent example of unusually good casting characteristics of one metal offsetting a decidedly higher material cost. Originally priced in SAE 8620 steel, it was changed to beryllium copper at a 15% saving in unit price.



This simple textile machine part requires a high degree of wear resistance. Casting in the right metal provided better properties at lower cost than when machined from tool steel.

Get more complete information for this is only a small part of the story telling how the right metal selection for investment castings can often increase efficiency and reduce costs.

WRITE today for Bulletin 116-205 . . . it's FREE!

HITCHINER

Manufacturing Company

MILFORD 7, NEW HAMPSHIRE

REPRESENTATIVES IN PRINCIPAL CITIES

For more information circle No. 59 on the Reader Service Card

DATA IN ADS

continued from page 18

29. Die Casting Machine—Positive locking and finger-tip control are two of the outstanding features of the die casting machines described in a bulletin from Cuyahoga Industries, Inc.

30. Small Die Casting Machine—A new die casting machine to produce castings up to 2½ pounds is described in a bulletin from Cast-Master, Inc.

37. Data on Crucibles—A series of leaflets on die casting and permanent molding crucibles is offered by Crucible Manufacturers' Association.

86. Brass Powder Parts—Detailed information on the design properties, production, and application of brass and other nonferrous powder parts is available from The New Jersey Zinc Co. Included are 20 case histories of brass and nickel silver powder structural parts.

87. Plaster Mold Castings—A brochure from Ohio Precision Castings, Inc. describes the savings that are possible by casting small parts in plaster molds.

93. Permanent Mold Dies—A new reference catalog from Permanent Mold Die Co., Inc. describes production shortcuts in light alloy fabrication.

95. Die Cost Savings—Data sheets giving cost-analysis facts available from Richards Tool & Mold Co. describe savings of up to 70 percent on zinc and aluminum die casting with the use of standard "Master Mold" cavity blocks.

107. Brass Die Castings—to give all of the advantages of a pressure die casting with brass as the material are described in a 12-page booklet available from Titan Metal Mfg. Co.

118. Complete Finishing—Basic process, chips, compounds, and a complete equipment line is described in a technical data folder from Roto-Finish Co.

119. Investment Casting Furnaces—Full information is available from Detroit Electric Furnace Div., Kuhlman Electric Co. on two new direct-casting electric furnaces for investment casting.

For die casting and permanent MOLDING of Aluminum or Copper Alloys

USE CRUCIBLES *for* MELTING *and* HOLDING

Here's why...

For "cold chamber" die casting and permanent molding, melting and holding the metal in crucibles is preferred because of lower cost, better regulation and "crucible" quality metal.

Crucibles are easier to clean and keep clean. There is less build up of aluminum oxide and dross and no penetration of the crucible wall. Iron contamination is completely eliminated.

Automatic temperature control is readily maintained.

Gas or oil fuel used with crucibles provide the lowest available heat cost.

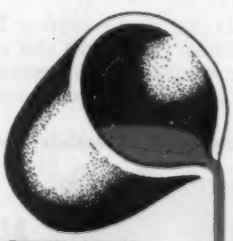
Crucible furnaces may be shut down over night or during non-working periods without any fuel consumption or supervision.

Battery of "ladle-out" crucible furnaces in a permanent mold foundry. Working capacity each furnace, 300 lbs. of aluminum.
Photo courtesy The Campbell-Hausfeld Co., Harrison, Ohio

THESE FIRMS CAN TAKE CARE OF ALL YOUR REQUIREMENTS FOR CRUCIBLE MELTING.

LAVA CRUCIBLE-REFRACTORIES CO.
AMERICAN REFRACTORIES & CRUCIBLE CORPORATION
JOSEPH DIXON CRUCIBLE CO.
VESUVIUS CRUCIBLE CO.
ELECTRO REFRACTORIES & ABRASIVES CO.
ROSS-TACONY CRUCIBLE CO.

Have you seen the new "'CRUCIBLE CHARLIE' says . . ." leaflets issued by Crucible Manufacturers Association? If not, ask your superintendent about this. He has a copy.



Crucible Manufacturers' Association

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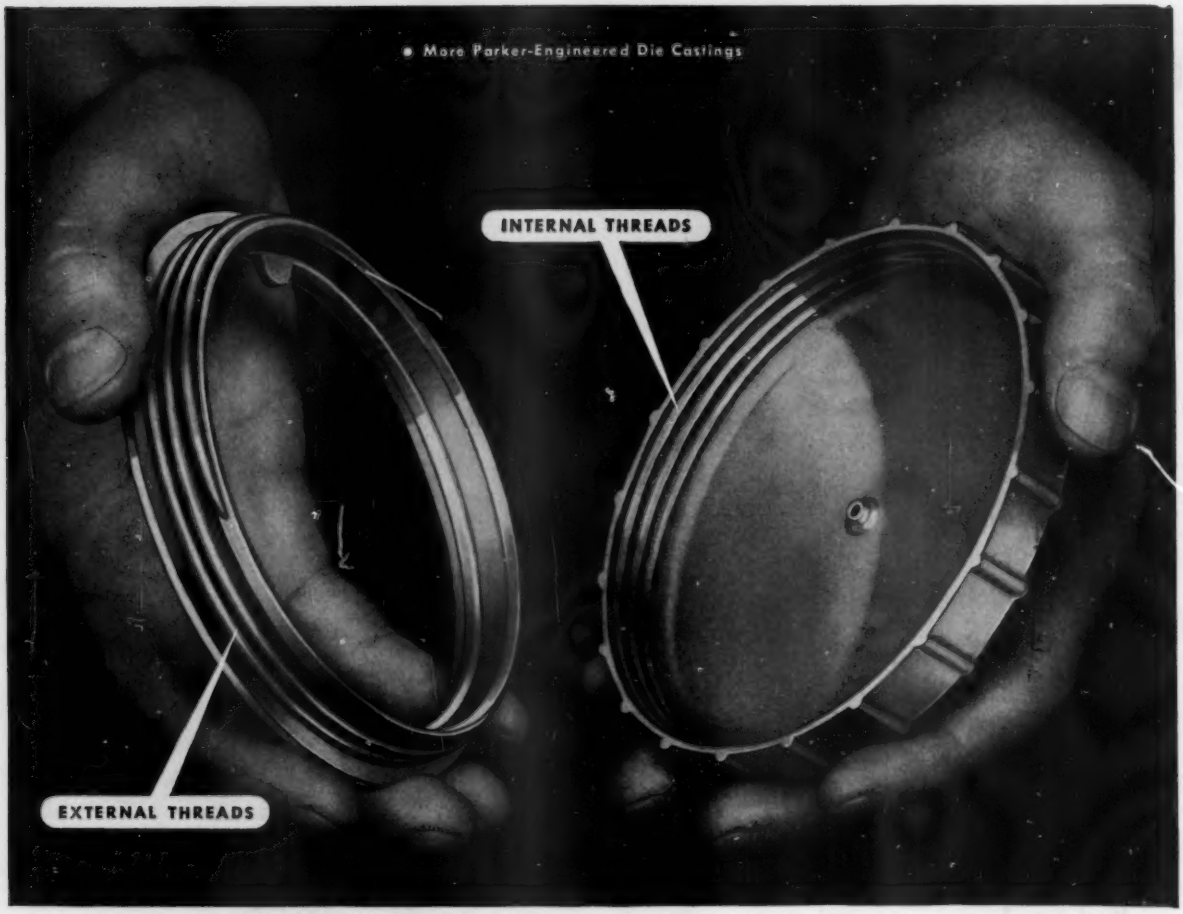


From ONE Die: TWO Parts... THREE Savings!

PARKER SALES ENGINEERS

CHICAGO 49, Ill.
Ollie J. Berger Company • 2059 East 72 Street

CINCINNATI, Ohio
William H. Broxterman • 2174 Buck Street

DETROIT 35, Mich.
Hodgson-Geisler Co. • 18917 James Couzens

GIRARD, Penna.
Daniel F. Marsh • 35 Chestnut Street

KIRKWOOD 22, Mo.
Edward F. Higgins, Jr. • 102 West Adams Street

WILTON, Conn.
Girard L. Palmer • Belden Hill Road

SYRACUSE, N. Y.
J. C. Palmer • 712 State Tower Bldg.

BELLEFONTE, Penna.
Warren G. Olson • 420 East Linn Street

These two mating parts, including the threads, are cast simultaneously in the same die. The result—three savings:

1—One die instead of two *saves die cost*

2—Casting two parts at one time in the same die *saves production time*

3—Precision casting of the perfectly mated threads with no parting line *saves machining cost*

Together, these three savings result in a substantially lower cost per piece. Just another example of the way Parker-engineered die castings save you money.

Parker has been a leader in die casting for over 50 years—an old hand with new ideas. This skill and experience can solve problems — and save money—on *your* component parts. Just call the nearest Parker sales engineer or write the factory direct.

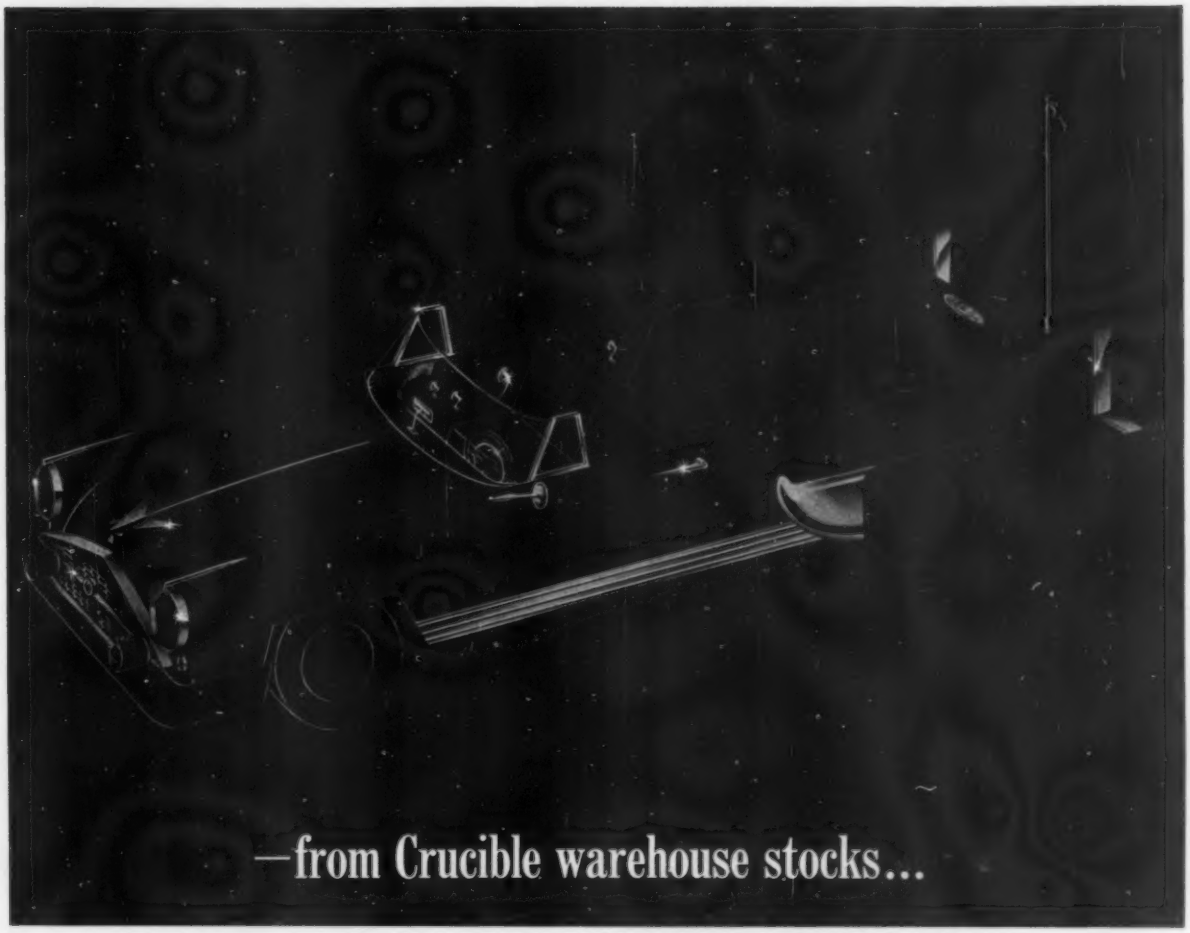
Parker White Metal Company • 2153 McKinley Ave., Erie, Pennsylvania

PARKER

high pressure ALUMINUM and ZINC die castings

POWDERED METAL PARTS

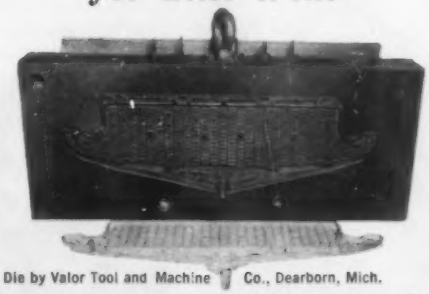
For more information circle No. 88 on the Reader Service Card



ultrasonically inspected CSM 2 DIE CASTING DIE STEEL

for auto trim

Like so many other automotive trim and hardware dies, Crucible CSM 2 was selected from warehouse stock for this long-run grill die. Built from a prehardened 25″ x 15″ bar, it produced 341,598 parts during the model year, and is now used for replacement parts.



Die by Valor Tool and Machine Co., Dearborn, Mich.

Like all Crucible die steels, it was ultrasonically inspected. This assures you of sound die steel quality — every time. It's a big reason why CSM 2 . . . and its partner for aluminum die casting, NU DIE V . . . are so popular that they're stocked in more than 430 sizes in Crucible warehouses from coast to coast. These sizes range from 1″ to 40″ wide . . . ¾″ to 15″ thick — and can be cut to your specifications at the warehouse.

For your die steel requirements — for holder blocks, solid dies, inserts or sleeves — you'll get *fast* delivery, sound quality from your local Crucible warehouse. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributer — Railway & Power Engineering Corp., Ltd.

For more information circle No. 36 on the Reader Service Card

UniFide®

TITANIUM POWDER

99+% pure

- Stable in air
- High green strength
- Pure, or Alloyed
- Low Oxygen
- Low Nitrogen

Available in all mesh sizes from

UNITED INTERNATIONAL RESEARCH, INC.

38-15 30th Street, Long Island City, New York

Write for Literature

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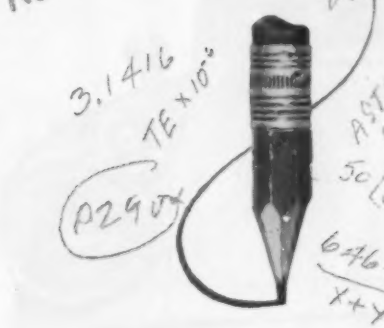
take the shortcut . . .



Let PMD solve your light alloy tooling problems!

Lightweight metals for heavy weight jobs. That's the trend!

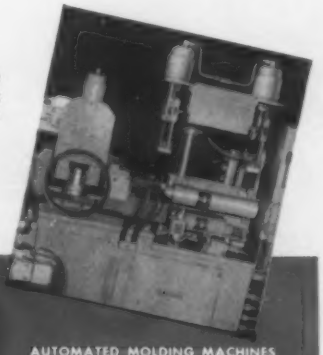
Progressive new developments . . . advanced techniques in the field of light alloy tooling have greatly increased the range of parts capable of being produced by die casting and permanent mold methods. Many new design concepts are possible, as a result, providing the designer with the opportunity of introducing unique and practical advantages into the product—advantages obtainable in no other way.

PMD has worked cooperatively with many leading companies to enlarge the scope of light alloy fabrication, and has pioneered many of the significant developments in this field. One of America's largest independent producers of light alloy tooling, PMD's facilities are extensive and exceptionally complete. The men . . . machines . . . the engineering know-how—plus an experience-record of proved performance!

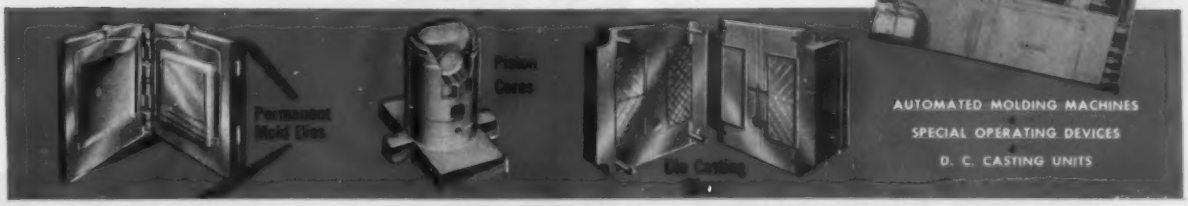
Take the short cut to improved product quality, increased output and lower costs! Call in a PMD specialist to discuss your light alloy fabrication problems. Write or phone today.

PMD

Write today for new PMD reference catalog. PERMANENT MOLD DIE COMPANY, INC. 2271 East 9 Mile Road — Hazel Park, Michigan SLocum 7-8100 (Detroit)



Complete Design, Engineering, Technical Services Available

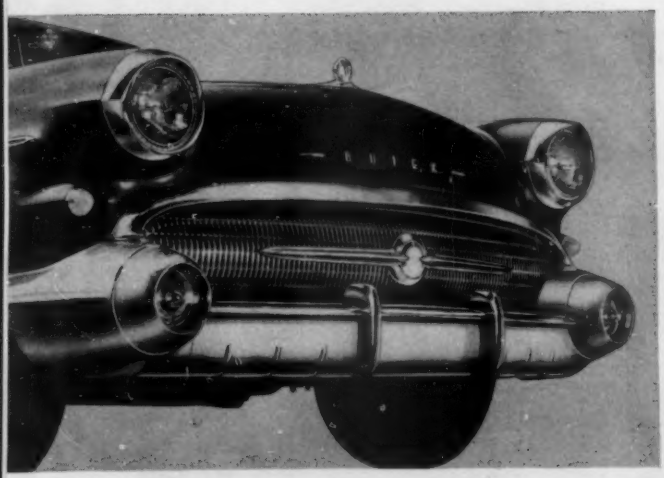


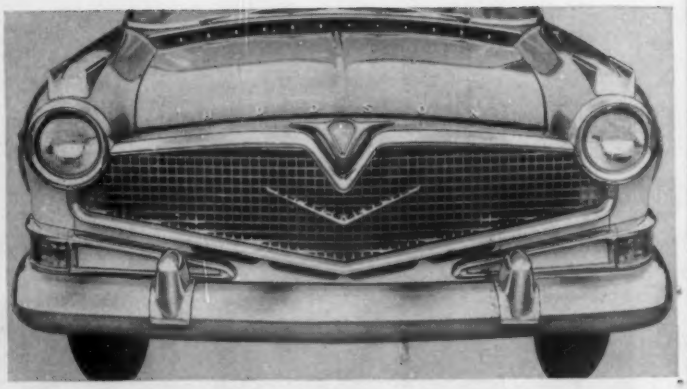
For more information circle No. 93 on the Reader Service Card

There's a Good Reason Why

ZINC

in





The research was done and the Zamak die casting alloys were developed with

HORSE HEAD SPECIAL (99.99 + % Uniform Quality) **ZINC**

DIE CASTINGS
Are so widely used
1957 AUTOMOBILES

More cars than ever before carry more ZINC Die Castings than ever before—in the new models for 1957.

Automobile designers are again taking fullest advantage of the flexibility of design that is inherent in the die casting process. Again, they turn to ZINC Die Castings to achieve major changes in appearance and durability—at minimum cost in tooling and production.

The Reasons Why

FLEXIBILITY—DURABILITY—ECONOMY

Among these outstanding examples of 1957 automobile styling are some that have used ZINC Die Castings in the past and then turned temporarily to other materials. THIS YEAR, THEY HAVE RETURNED TO ZINC to offer the public the ultimate in quality, appearance and performance.

As the largest consumer of ZINC Die Castings, the automobile industry has proved beyond question that the final choice in making these improved products is ZINC.

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ZINC
FOR DIE CASTING ALLOYS

THE NEW JERSEY ZINC COMPANY

160 FRONT STREET, NEW YORK 38, N. Y.

SMALL PARTS CAN MAKE BIG TROUBLE

We produce small zinc die castings (up to five ounces) that are dense, platable and inexpensive, on equipment of our own design and construction.

If one of these castings looks at all like some component of yours — regardless of how you're now producing it — you'll do well to contact us. We'll show you how a progressive, specialized die casting firm can ease your small-parts procurement pains.

Springfield Die Casting Co., Inc.

Chestnut 5-0609

721 Lexington Ave. • Kenilworth, N. J.

circle No. 102 on the Reader Service Card

BETWEEN THE LINES

the editor's viewpoint on articles in current and forthcoming issues

A MANHOLE COVER FROM SINTERED ALUMINUM POWDER? Yes, that's one of the products fabricated from aluminum sheet, bar and rivets produced from S.A.P. Also, you'll find forged aluminum pistons, connecting rods, heat circulating fans, and other products being made from this material. The complete background data for using S.A.P. is compiled for you by one of its developers, starting on page 60 of this issue.

YOUR BUYING GUIDE FOR DIE CASTINGS is the central feature of this issue, starting on page 71. You'll find an authenticated list of die casters, alphabetically, geographically and by trademarks. We have also identified which alloys they cast and what secondary facilities they have available for machining, finishing etc. A limited quantity of extra copies of this issue will be available for your purchasing department.

DESIGN POINTERS FOR INVESTMENT CASTING will be a reference piece in PMM's February issue. A number of leading investment casters have contributed their ideas on ways that you can improve your designs. The two previous sets of design pointers on die casting and powder metallurgy were snapped up immediately after publication. In fact, the pointers to help in designing die castings have already been reprinted widely in this country, England, France and Germany.

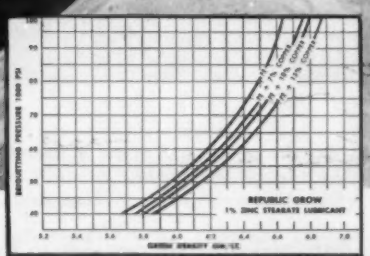
THERE'S NO FORMULA FOR BARREL FINISHING. Any finishing engineer will tell you that each job must be evaluated by itself. Plenty of trial and error goes into the preliminary study to find the best barrel cycle. However, you can learn some general principles and can benefit by the experience of others processing similar parts. Therefore, PMM has collected a number of case histories on barrel finishing, and will publish them in our Finishing Section next month.

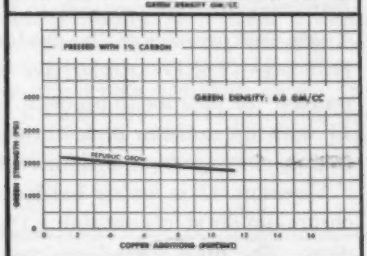
WITH TAXES AND LABOR RATES WHAT THEY ARE, we're finding an increasing tendency for companies to consider other factors besides the simple piece cost when selecting a method of producing their components. How much floor space will it occupy, what about shortages of skilled labor, how much finishing will we have to do, will we have to buy new capital equipment? These considerations are of increasing importance now, and very often favor the use of PMM parts, as is illustrated in two articles this month on pages 51 and 58.

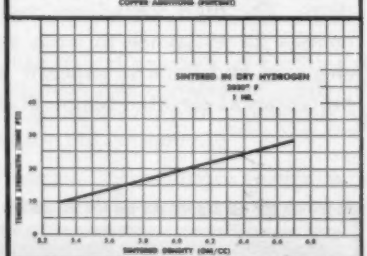
NEW Type "G" (Grow)

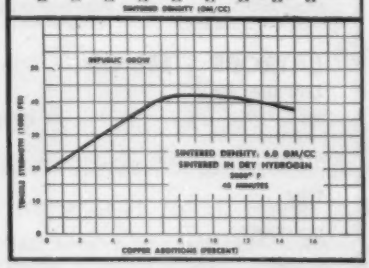
REPUBLIC IRON POWDER WITH

Controlled dimensional factor









Developed for use in your existing dies

Type "G", indicating growth, is one of three new grades of iron powder now being produced by Republic. Each has a distinct dimensional change characteristic when blended with copper. This change characteristic is called *Controlled Dimensional Factor* —an exclusive Republic development.

Type "G" is a powder having a definite growth characteristic in the presence of copper. It offers a major economic advantage to fabricators of iron powder parts in that it was developed for use in *existing* dies designed for powder which expands when sintered.

The accompanying charts show the briquetting, sintering, density and strength characteristics of Type "G" Iron Powder. This information represents the average of numerous tests conducted in the development of this new iron powder. For standardization purposes, all values are the result of sintering in a dry hydrogen atmosphere.

For complete information on all three grades, including chemical composition and physical properties, write for Republic Booklet Adv. 763.

REPUBLIC STEEL

Metal Powder Division • Toledo 5, Ohio

GENERAL OFFICES • CLEVELAND 1, OHIO

For more information circle No. 94 on the Reader Service Card

Another product of Latrobe's

Research and Development

The Aristocrat of Die Casting Die Steel

New

pre-hardened

VISCOUNT 44

Die Casting Die Steel

Eliminates heat treat after machining!

Viscount 44, Latrobe's new prehardened die casting die steel, offers tremendous advantages when used for die casting dies. Furnished prehardened, in a range of Rockwell C 42-46, the use of this steel eliminates the need for heat treatment after machining . . . no need to worry about size change or distortion due to heat treatment.

The machinability of Viscount 44 in the prehardened state is made practical through the introduction of fine, evenly dispersed sulphide particles to the steel. Years of experience in the production of DESEGATIZED® steels have made it possible for Latrobe to produce Viscount 44 with its uniform distribution of the free-machining sulphide additives.

Viscount 44 is an air hardening, 5% chromium die steel containing 1% Vanadium. The high Vanadium content increases its resistance to wash and heat checking and imparts superior physical properties at elevated temperatures.

Latrobe

STEEL COMPANY

Main Office and Plant: Latrobe, Pa.

Branch Offices and Warehouses Located in Principal Cities

Mail today for further information and stock sizes

LATROBE STEEL CO.,
Latrobe, Pa.

Please send more data on Viscount 44.

NAME.....

TITLE.....

COMPANY.....

STREET.....

CITY.....STATE.....

Circle No. 69 on the Reader Service Card

DOLLIN DIE-CASTINGS

meet critical requirements in FAIRCHILD ½" ELECTRIC DRILLS

- Light weight
- High strength
- Compactness
- Accuracy
- Appearance
- Low cost

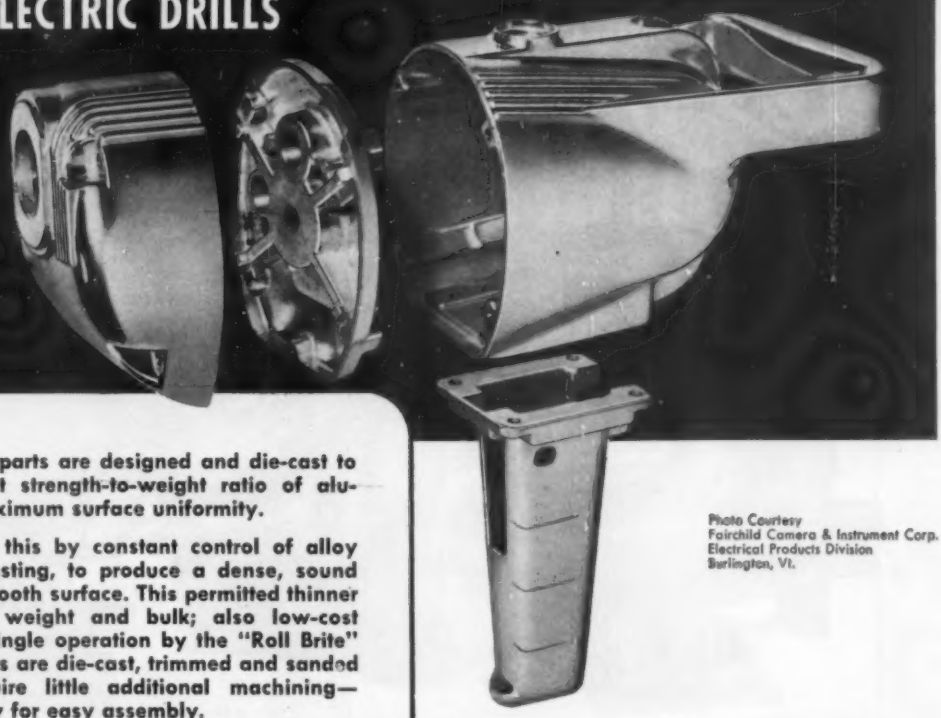


Photo Courtesy
Fairchild Camera & Instrument Corp.
Electrical Products Division
Burlington, Vt.

These attractive parts are designed and die-cast to gain the highest strength-to-weight ratio of aluminum, plus maximum surface uniformity.

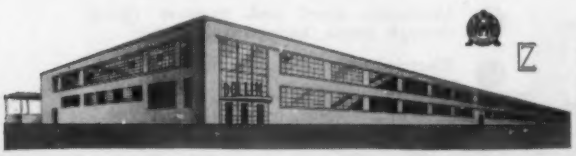
Dollin achieved this by constant control of alloy purity during casting, to produce a dense, sound structure and smooth surface. This permitted thinner walls, reducing weight and bulk; also low-cost polishing in a single operation by the "Roll Brite" method. All parts are die-cast, trimmed and sanded by Dollin—require little additional machining—match accurately for easy assembly.

This is another typical example of Dollin's wide experience and facilities concentrated on producing the best possible die-casting for the job . . . with the biggest possible savings for the customer.

Let us demonstrate Dollin service to you. Submit prints, samples or problems for engineering advice and quotation, without obligation.

LARGE CASTINGS Aluminum castings made on large cold chamber type high-pressure machines. Large zinc castings made on large plunger type machines.

SMALL ZINC CASTINGS 1000 per lb. to 3 per lb., made on specialized, high-speed, fully automatic machines. Wide design latitude, reduced machining, low piece cost.



Dollin Corporation 614 So. 21st St., Irvington 11, N. J.

SALES OFFICES: Boston • Buffalo • Canton • Charlotte • Chicago • Detroit • Louisville • Philadelphia • Pittsburgh • St. Louis • St. Paul

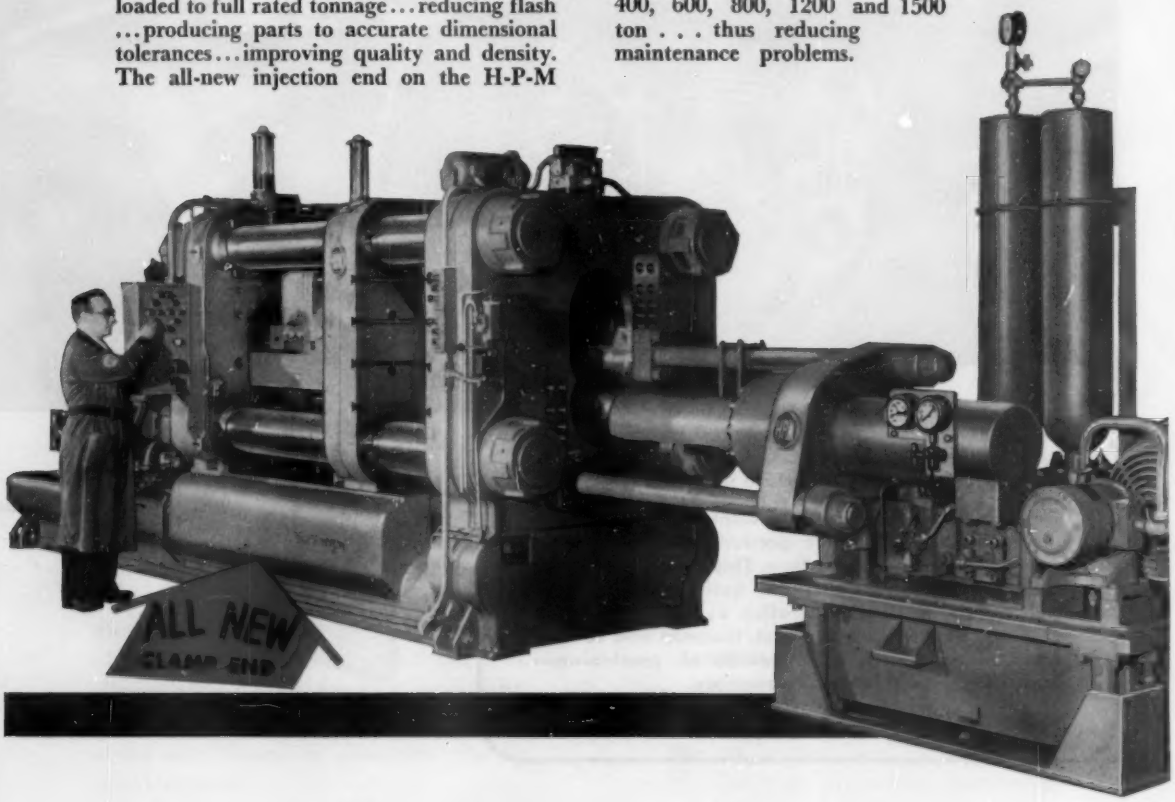
DOLLIN Zinc and Aluminum DIE-CASTINGS

For more information circle No. 41 on the Reader Service Card

first all-new die casting

Backed by two years' field performance plus four years' research and development.

All new—from stem to stern—that's H-P-M's Die Casting Machine. Result? Better die castings for you. H-P-M's new exclusive mechanical link-wedge lock is the heart of the new design. There's plenty of "beef" in locking and frame members. The clamp is preloaded to full rated tonnage... reducing flash ...producing parts to accurate dimensional tolerances... improving quality and density. The all-new injection end on the H-P-M die caster is based on entirely new theories of metal injection pioneered by H-P-M. You benefit from a more compact unit plus greater dependability and closer control of hydraulic action. Design is standard on all six sizes — 200, 400, 600, 800, 1200 and 1500 ton . . . thus reducing maintenance problems.



Do These FEATURES Solve Your Problems?

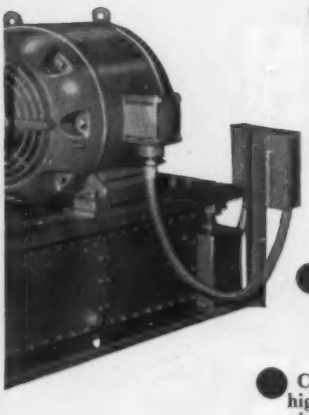
We Believe They Do!

- Positive, self-compensating lock to the rated tonnage or better . . . high mechanical advantage from flat-faced wedges and knuckle joint links.
- Less die flash . . . plenty of "beef" in rods, platens, locking mechanism . . . large bearing areas—low bearing load.
- Complete manifolding of all high-pressure hydraulics.
- No tie rod nut adjustment . . .push-button control for central screw daylight adjustment . . . easy die set-up and tonnage control.
- Maximum speed and pressure cycles through ample horsepower.
- Electric-hydraulic safety interlock . . . control of stroke, slowdowns . . . automatic cycling including three core pull sequence . . . complete flexibility of operation.

machine in 15 years

ALL NEW
INJECTION END

- A completely self-contained unit . . . not dependent on clamp end for operation.
- Independent injection end permits generous open floor area for automatic ladling furnaces and devices.
- Positive pressure follow-through with no delay . . . injection pressures to 30,000 psi . . . no need for auxiliary intensifiers.
- Injection speeds up to 1,000 feet per minute with ASME coded 2500 lb. accumulators.
- Complete control, through special valves, for any distance—speed curve.
- Complete manifolding of all high-pressure hydraulics . . . no swivel joints or hose.
- Flexible injection stroke for control of metal volume and cover die thickness.



Here's "blue chip" acceptance!

Ajax Die Casting Co.
Aluminum Co. of America
Char-Lynn Co.
Globe Imperial Corp.
Hamilton Die Casting Co.
Kiekhaefer Corp.
Kiowa Corporation
Leland Electric Co.
Mall Tool Co.
Midwestern Die Casting Co.
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The Hoover Co.
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☐ Send Complete Information
☐ Have Engineer Call

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

HPM

THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.
A DIVISION OF KOEHRING COMPANY

For more information circle No. 61 on the Reader Service Card

FOR BETTER DIE-CASTING

AMERICAN METAL ZINC-BASE ALLOYS

In the manufacture of zinc-base alloys at American Metal, Quality Control is a continuing effort . . . pursued through every phase of production . . . to ensure that characteristics are rigidly controlled to give you sounder, more uniform die-castings.

When you specify American Metal zinc-base alloys, you specify:

Premium-grade raw materials •

Sampling and testing at every production step •

Careful supervision and efficient plant and personnel •

Spectroscopic inspection •

Backed by this Quality Control and years of know-how, American Metal delivers the precise zinc-base alloy you order . . . when you need delivery.

Technical assistance and further information about American Metal Zinc-Base Alloys are available upon request.

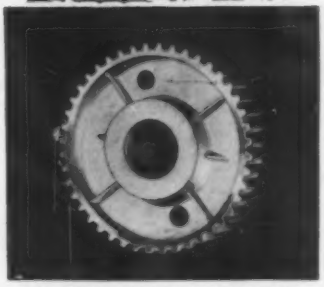
Metal Sales Department
THE AMERICAN METAL COMPANY, LTD.
61 Broadway, New York 6, N. Y.

For Parts that *HAVE* to "TAKE-IT"

Die Castings of Aluminum and Magnesium Provide Dependable Strength

DIE CAST COUPLING, BUILT TO WITHSTAND HYDRAULIC BURSTING PRESSURES

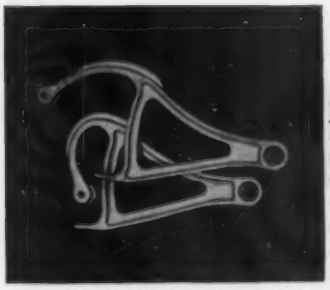
Illustrated here are some parts by LITEMETAL that prove Die Castings are not restricted to "sissy" jobs. More and more, as the techniques and equipment for die castings improve, die cast parts are being called upon to do brute strength jobs. Some, such as fans, are required to withstand screaming spin speeds of 17,000 r.p.m., and more. Others must withstand high torque loads, hydraulic bursting pressures, terrific impact or heavy bending loads. Such demands can be met if careful co-operation between customer and die casting engineers, early in the planning stages, is such as to bring out the best in casting design and alloy selection. Quality standards which realistically control the functional requirements of the part must also be established before manufacture of tools and castings is begun.



DIE CAST DRIVE GEAR FOR CHAIN SAW, BUILT TO WITHSTAND HIGH TORQUE LOADS

THE ABOVE DIE CAST TRIPOD BASE BEARS HEAVY LOAD PRESSURES

DIE CAST COOLING FAN THAT WITHSTANDS HIGH SPIN SPEEDS OF 17,000 RPM — PLUS

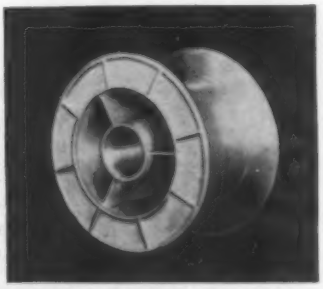


DIE CAST LADDER LOCK WITHSTANDS SHARP BLOWS — NOTE BACK PORTION OF PHOTO WHICH ILLUSTRATES TOUGHNESS

Let's Talk It Over . . .

LITEMETAL DICAST, INC. is an organization of specialists — men thoroughly experienced in the casting and machining of magnesium and aluminum alloys. Our equipment includes big machines for big jobs — little machines for little jobs . . . the right sizes and types of the most modern die casting equipment for producing parts from the size of a button to large cable spools. Complete facilities for secondary operations are also available.

Write today for literature and design information. Quick action on inquiries.



DIE CAST SPOOLS HAVE FLANGES THAT RESIST GREAT BENDING PRESSURES UNDER HEAVY LOADS OF TENSION WOUND WIRE AND NYLON

LITEMETAL DICAST, Inc.

A DIVISION OF HAYES INDUSTRIES

1925 WILDWOOD AVE · JACKSON, MICHIGAN

PLANT AND EXECUTIVE OFFICES

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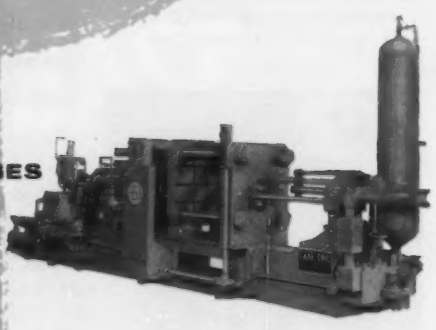
The sign of **QUALITY** in Die Casting Machines

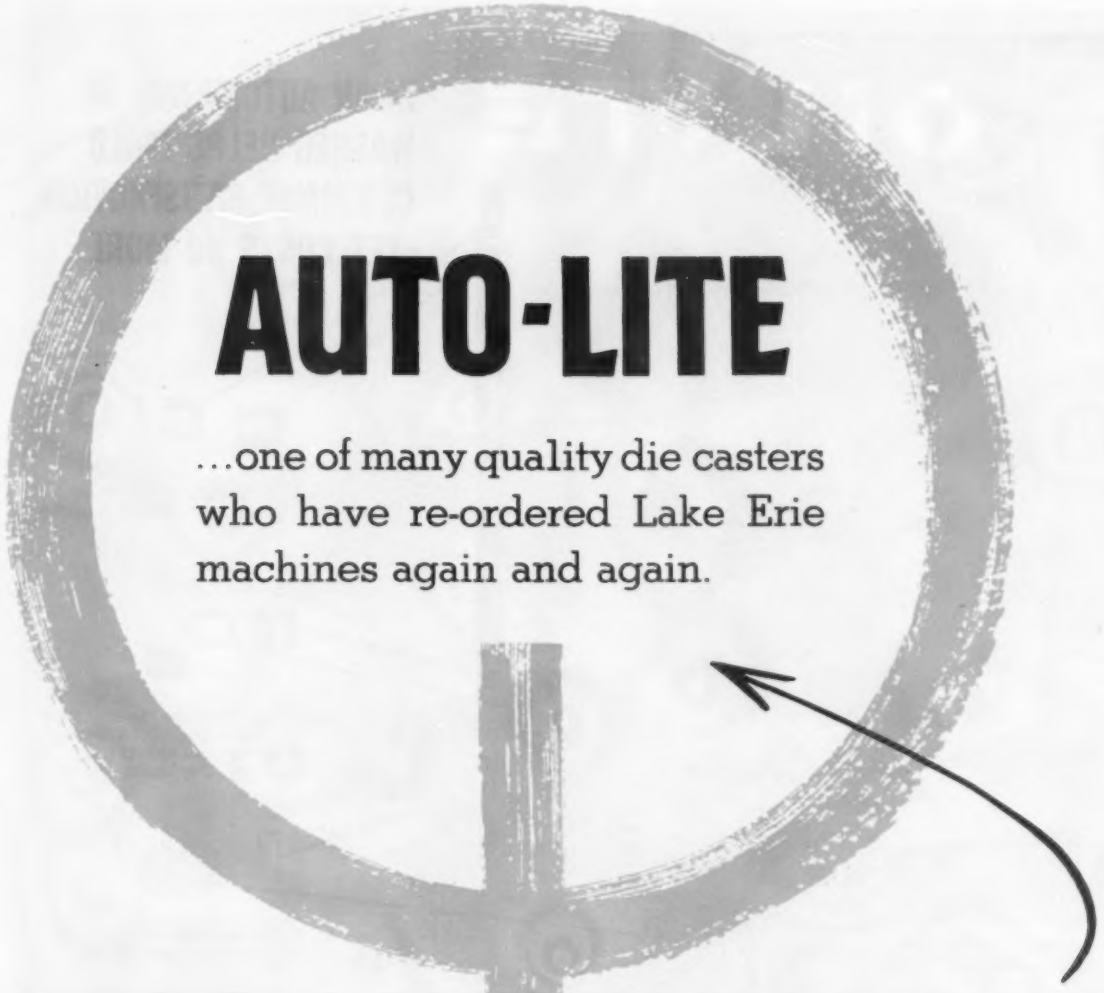
LAKE ERIE

HOT AND COLD CHAMBER MODELS IN ALL TONNAGES



AUTO-LITE

...one of many quality die casters who have re-ordered Lake Erie machines again and again.



The sign of QUALITY die castings produced on 83 Lake Erie machines

"The (Continental) Mark II's grille is made by The Electric Auto-Lite Company, Toledo, Ohio. Ford engineers picked this company because it could maintain the quality standards they were seeking."

STEEL Magazine—May 28, 1956

LAKE ERIE®

LAKE ERIE ENGINEERING CORPORATION, 520 Woodward Ave., Buffalo 17, New York

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OILITE
IN AN AUTOMATIC WASHER HELPS BUILD CUSTOMER SATISFACTION -YET COSTS NO MORE
OILITE bronze agitator shaft bearing
OILITE bronze upper center post bearing
OILITE bronze rubber-mounted lower center post bearing
OILITE bronze thrust washers (2)
OILITE bronze pulley bearing
OILITE bronze thrust bearing
OILITE bronze water pump bearing
Photos courtesy Whirlpool-Seeger Corporation St. Joseph, Michigan
Andther cost-saving application of Amplex Powder Metallurgy

Quality is a *must* for trouble free operation, continued customer satisfaction. And quality depends upon the excellence of every part, every component. For many years Whirlpool-Seeger has used OILITE center post bearings, agitator shaft bearings, water pump bearings and pulley bearings in their automatic washers. Whirlpool-Seeger uses these and other OILITE parts for very good reasons.

First of all, the manufacturer knows OILITE heavy-duty bronze bearings will meet specifications. Chrysler-Amplex precision production assures him OILITE bearings capable of carrying their loads safely, surely and quietly.

Then too, Chrysler-Amplex plant and facilities—largest and most complete of any in the metal powder fabrication industry—promises on-time deliveries in any quantity.

Moreover, in using OILITE bearings the manufacturer selects a product his customers know and respect for superior engineering.

Finally, this manufacturer, like a great many others, finds OILITE bearings—despite all their advantages—cost no more.

Chrysler-Amplex representatives and dealers are located in principal cities in United States and Canada. Let the nearby representative help you. Find him in the yellow section of your telephone directory under—"Bearings—OILITE."

Representatives and dealers located in principal cities in United States and Canada.

A CHRYSLER OILITE PRODUCT

Only Chrysler Makes **OILITE**

AMPLEX DIVISION

CHRYSLER CORPORATION • DETROIT 31, MICHIGAN

It's New! It's Free!

S-56; Standard OILITE Bronze Bearing Stock List. All standard sizes—over 1000 sleeve, flange and thrust bearings, cored, bar and plate stock—are listed in this handy, easy-to-use booklet. Write for your copy today. Address: Dept. 1F, Chrysler-Amplex Division, P.O. Box 2718, Detroit 31, Michigan.

Bearings • Finished Machine Parts • Permanent Metal Filters • Friction Units

Ferrous and Non-Ferrous Metals

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choose

REXALLOY

cast

parts

for

high strength • corrosion and abrasion resistance • fine finish

When high-hardness—even at elevated temperatures—resistance to corrosion and abrasion, and smooth, clean finish are important—Crucible REXALLOY® can't be beat. It's a chromium-tungsten-cobalt base nonferrous alloy.

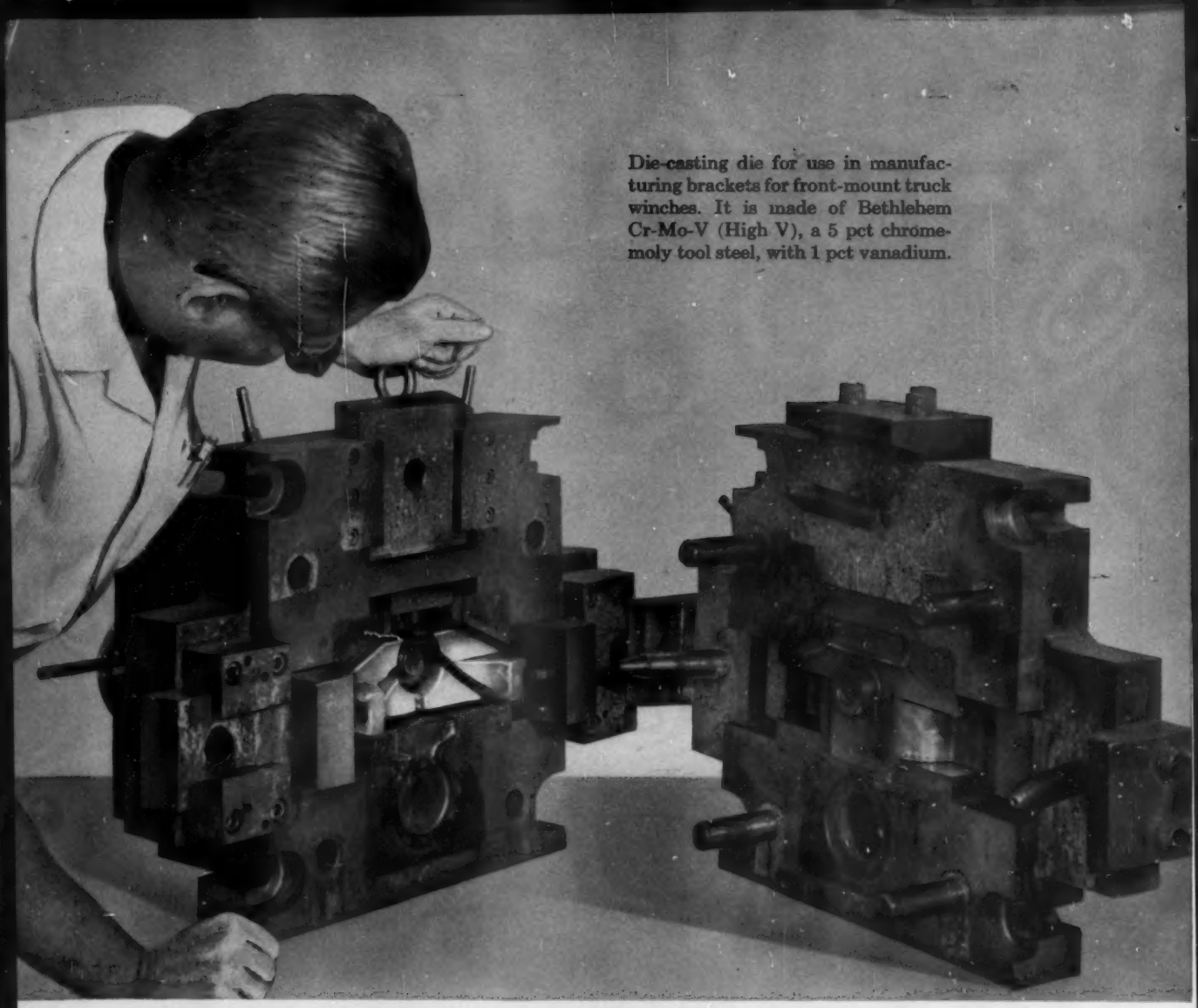
What's more, REXALLOY parts can be produced to close tolerances, in almost any shape, by either investment, sand, or the new shell-mold casting process. Finishing operations are practically eliminated—costs substantially reduced.

Check on the advantages one of the many types of REXALLOY castings has for your product. Your Crucible representative will give you all the facts. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

For more information circle No. 35 on the Reader Service Card



Die-casting die for use in manufacturing brackets for front-mount truck winches. It is made of Bethlehem Cr-Mo-V (High V), a 5 pct chrome-moly tool steel, with 1 pct vanadium.

DIE: Cr-Mo-V (HIGH V)
PROSPECT: Long Production Run

Here, undergoing inspection at Production Die Casting Company, Houston, Texas, is a die-casting die for use in manufacturing brackets for front-mount truck winches, being produced by Koenig Iron Works, Inc., also of Houston. Engineers at Production Die Casting Company know they can count on the die for long, economical service because it's made of Cr-Mo-V (High V)—Bethlehem's 5 pct chrome-moly tool steel, with 1 pct vanadium.

Cr-Mo-V (High V) stands up in long production runs because it's a high-quality steel, with good grain-refinement, uniform center-density and freedom from porosity. It also makes possible dies which can be polished to a high lustre and impart a smooth surface to the casting. Because of its balanced analysis and high vanadium, it affords good resistance to surface washing and erosion. And as for cleavage-cracking, that's no problem at all when adequate radii are used in the die and the steel is properly heat-treated.

Cr-Mo-V (High V) is made by means of a controlled melting procedure, plus adequate forging reduction. Its high quality is double-checked by means of ultrasonic testing. It's easy steel to machine because it is annealed to Brinell 217 max. What's more, it responds uniformly to heat-treatment, even in massive sections, producing a uniform hardness of Rockwell C 45-47.

If you have any questions about Cr-Mo-V (High V), whether casting aluminum, zinc or magnesium, call your Bethlehem tool steel distributor.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

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PMM PATENTS

Copies of all patents reviewed can be secured from U. S. Patent Office, Dept. of Commerce, Washington, D. C. for 25¢ each.

HIGH TEMPERATURE ALLOY and articles made from it for use in repetitive heating and cooling cycles at temperatures up to 1000 F. The alloy is composed of 10 to 30 percent chromium; up to 25 percent of at least one metal selected from molybdenum and tungsten; up to 5 percent of at least one metal selected from the group of tantalum, titanium and columbium; up to 25 percent iron; up to 1 percent carbon; up to 0.5 percent boron; and the balance nickel or cobalt plus normal incidental impurities. Articles made from this alloy shall have a skin from 0.001 to 0.01 in. thick that is substantially free of both carbon and boron.

Metal Articles for use at Elevated Temperatures—U. S. Patent No. 2,763,584 — Frank S. Badger — assigned to Union Carbide and Carbon Corp., issued Sept. 18, 1956.

A ROLLING ARRANGEMENT FOR COMPACTING POWDER in a continuous process to form metal strip. Two rotatable rolls are arranged with a variable space between them so as to grip and compact the metal powder between the rolls. A covering means extends over a portion of the rolls for varying the total effective powder contacting area of the rolls.

Rolling Strips from Metal Powder —U. S. Patent No. 2,758,336— Hermann Franssen, Oberhausen, Germany—issued Aug. 14, 1956.

EQUIPMENT FOR BARREL FINISHING ALUMINUM DIE CASTING consisting of a rotatable barrel mounted on its longitudinal axis. One end of the barrel is open and provided with a removable cover. A supporting rack to hold the die castings is mounted inside the barrel and coaxially with the drive shaft and arranged to slide over the central shaft.

Apparatus for Burnishing Aluminum Die Castings—U. S. Patent No. 2,758,362—Clarence W. Benedict—assigned to Roll-Brite Corp. —issued Aug. 14, 1956.

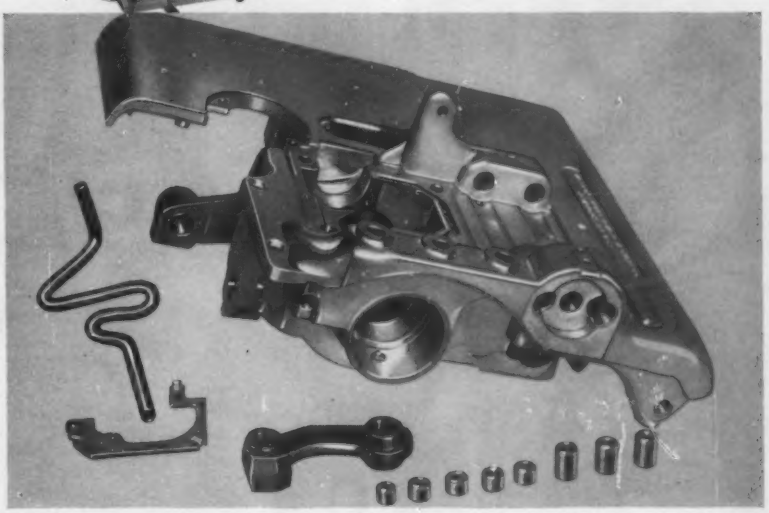
AN INVESTMENT MATERIAL prepared as a slurry consisting of a plaster bonded silica mixture having from 0.05 to 1.0 percent by weight of agar in the mixing liquid.

Investment Casting of Metals—U. S. Patent No. 2,758,936—Hyman Rosenthal and Samuel Lipson—assigned to United States of America, Dept. of the Army—issued Aug. 14, 1956.

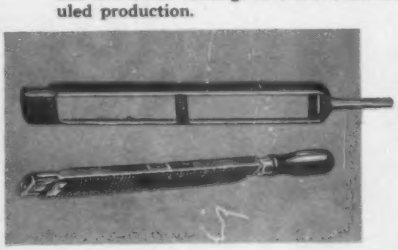
Continued on page 110

DIE CASTING REPORT

Intricate casting solves tough redesign problem . . . on new HIGH SPEED SEWING MACHINE



Lightning fast starts and stops are only one feature of this Willcox & Gibbs rugged commercial sewing machine which does seaming, hemming, edging and serging operations. High performance is due to progressive design engineering which resulted in a zinc frame die casting (shown above) with 11 inserts, two loose pieces in the die and core pulls in four directions. For over twenty years our engineers have cooperated closely with Willcox & Gibbs Sewing Machine Company, in redesigning this and other castings to achieve lowest possible unit costs consistent with scheduled production.

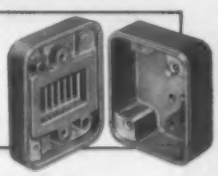


DIE CAST ALUMINUM FRAME ADDS RIGIDITY

The new "Surform" manufactured by the Stanley Tool Division of the Stanley Works is housed in a holder of die cast aluminum. Lightness and rigidity, plus rapid duplication of identical parts with a good smooth surface dictated the selection of the die-casting method.

TV CHANNEL CHANGER

Sonic switch housing for Zenith called for absolute uniformity at reasonable cost. A zinc die-casting provided the answer. Precision, too, does drilling, tapping and honing as part of its integrated service.



The Precision Division is organized to meet all your die-casting requirements. Its integrated facilities include design, engineering, die building, machining, painting, plating and packaging. Try doing business with a firm which offers one contract, one responsibility. We welcome your inquiry.

PRECISION CASTINGS CO.

DIVISION OF **HARSCO Corporation**

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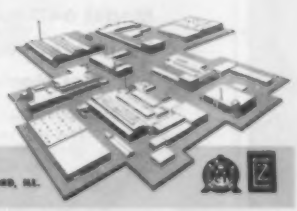
CHICAGO, ILL.—CLEVELAND, OHIO—KALAMAZOO, MICH.—DETROIT, MICH.—ROCKFORD, ILL.



For more information circle No. 90 on the Reader Service Card

Parts costs

Typical parts being produced on Stokes Model 640 Press by International Business Machines Corporation.

Feed pawl cost cut 64.6%

Sintered iron Tolerances:
thickness ±.002"
centerline to tip ±.002"
hole +.001", —.000"

Roll bearing cost cut 46.6%

Sintered bronze Tolerances:
O.D. +.000", —.001"
Bore: +.001", —.000"
Length: ±.001"

Ratchet cost cut 49.3%

Sintered brass Tolerances:
tooth form ±.002"
bore: +.002", —.000"

cut up to 65% at I.B.M.

—by compacting on STOKES powder metal press

On a Stokes 50-ton Model 640 press, International Business Machines Corporation produces a variety of powder metal parts at its Endicott, N.Y. plant. Close tolerances are maintained and costs are reduced up to 65%.

This is typical of the savings that powder metal processing can effect. On Stokes fully automatic compacting presses, many parts which are wasteful of metal stock, machine time and labor when made by conventional methods can be produced in high volume . . . at low cost. This technique applies to a wide range of metals, alloys and non-metallic powders . . . either pure or mixed. It often provides qualities unobtainable in the solid metal.

35 years experience in this field is the foundation for these outstanding features of the Model 640 press . . . latest addition to the extensive Stokes line of compacting equipment.

Easy setup and control . . . press adjustments operate independently, and are centralized at the front of the press. Handwheel calibrations are direct reading.

Precise tool alignment . . . protects tools, assures precision.

Clean operation . . . totally enclosed construction.

Full pressure breakaway at initial ejection eliminates possibility of pieces fracturing. All parts are fully supported during ejection; thin-flanged parts won't break.

Low maintenance, maximum safety . . . *plus great flexibility.*

Find out for yourself how Stokes powder metal pressing can cut parts costs. The Stokes service includes laboratory compacting of samples parts, accurate cost analysis, and design and production of punches and dies. Write today for the following literature: "Powder Metallurgy Today"; Catalog No. 801, "Stokes Powder Metal Presses"; Bulletin No. 670, "Stokes Model 640 Powder Metal Press."

Powder Metal Press Division

F. J. STOKES CORPORATION

5514 Tabor Road, Philadelphia 20, Pa.

STOKES

These leading custom producers profit from Stokes powder metal presses.

$25,000 yearly saved . . . $30,000 machine tool outlay avoided . . . by making lock parts on a Stokes press at Dixon Sintaloy, Inc., Stamford, Conn.

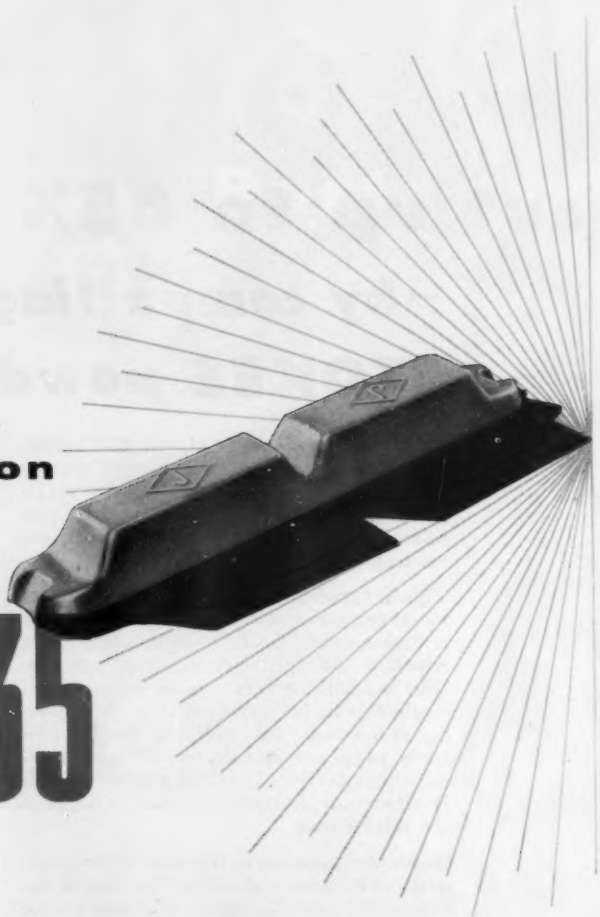
$20,000 per year cost-reduction was made on a wringer drive gear of iron and copper powder, for use on "Whirlpool" washers. Parts made by the Presmet Corporation, of Worcester, Mass. . . . on Stokes powder metal presses.

82% drop in cost is the story behind this drive gear for a home ice cream freezer . . . formed in a single operation on a Stokes press at Yale & Towne's metal products division, Franklin Park, Illinois.

For more information circle No. 99 on the Reader Service Card

Alloy with a Reputation

ALMAG 35



for highest purity available in aluminum alloys... As with any product of highest quality reputation, attempts are constantly made to equal the outstanding characteristics of Almag 35. Almag 35 cannot be duplicated by others because it is fully protected by patents.* Claims for equal or similar properties are false.

We do not take our patent responsibility lightly. No other aluminum alloy has ever been subjected to such rigid research and testing as Almag 35. Our purposes are to improve and refine, if possible, the outstanding properties Almag 35 has for high strength, ductility, dimensional stability, high shock and corrosion resistance.

Very shortly we hope to present to the trade another series of improvements in light metal alloy properties which may well change the standards for these metals in all classifications.

*U.S. Patents Nos. 2564044, 2583473, 2628899, 2733991 and 2764482.

Our 51st Year in Aluminum Alloys

WILLIAM F. JOBBINS, INCORPORATED

P. O. BOX 230 • AURORA, ILLINOIS

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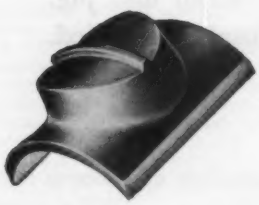
This do-it-yourself test proves

RESISTOX® Metal Powders are more stable, resist oxidation 5 to 10 times longer!



This test proves that the Resistox Process gives Glidden Metal Powders more stability through greater resistance to oxidation. You can store Glidden Resistox Metal Powders over long periods of time without fear of oxidation. And you can speed up production of metal parts, with less material-waste and die-wear, greatly improved finish, appearance, and performance characteristics.

In an open container, place a sample of Resistox copper or lead powder. In another, a like amount of an ordinary metal powder of the same type. Then wait . . . 3 days in hot humid weather, 2 weeks in cool dry weather. The striking difference in appearance that results (oxidation causes the ordinary metal powder to change color rapidly) will show comparative resistance to oxidation, prove superiority of Resistox Metal Powder.

Write for your free test-sample of Glidden Resistox Metal Powder (specify lead or copper) and complete information on these additional Glidden products: Cuprous Oxide, Cupric Oxide and Cubond (Copper Brazing Paste).

THE GLIDDEN COMPANY

CHEMICALS—PIGMENTS—METALS DIVISION

Baltimore, Md. • Collinsville, Ill. • Hammond, Ind. • Scranton, Pa.

QUALITY Glidden PRODUCTS — CHEMICALS PIGMENTS METALS

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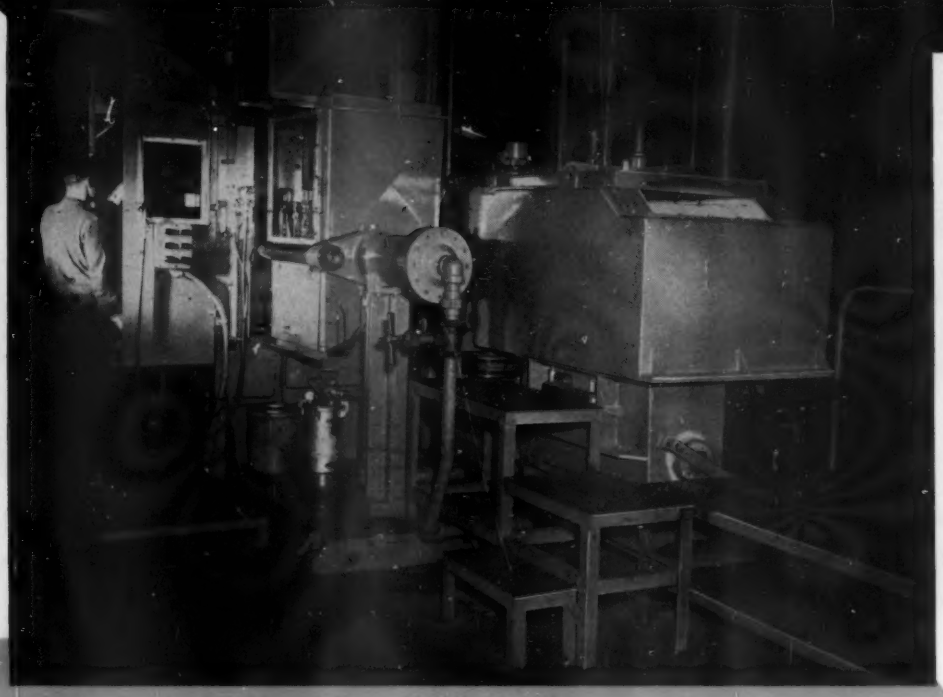
ALUMINUM MELTING AND DIE CASTING INTEGRATED....



with the duplex AJAXOMATIC®

With the touch of a button the operator releases the complete automatic cycle: die closing, *Ajaxomatic* pour, shot, cooling, die opening, ejection. Simultaneously, the Duplex *Ajaxomatic* melts batches of scrap and pig. Weight, time and temperature of each automatic pour are closely controlled.

RESULTS.... Higher production rate
Uniform casting quality
No molten metal handling
No operator fatigue
PRODUCTION.... Up to 500 pounds per hour
CASTING SIZE.... ½ pound to 20 pounds

(Special units available for higher ratings)

MAY WE STUDY YOUR REQUIREMENTS?

AJAX ENGINEERING CORP., TRENTON 7, N. J.

AJAX TAMA-WYATT

INDUCTION MELTING FURNACE

AJAX ELECTRO METALLURGICAL CORP., and Associated Companies
AJAX ELECTROTHERMIC CORP., Ajax Northrup High Frequency Induction Furnaces
AJAX ELECTRIC CO., The Ajax Hultgren Electric Salt Bath Furnace

® Reg. U. S. Patent Office

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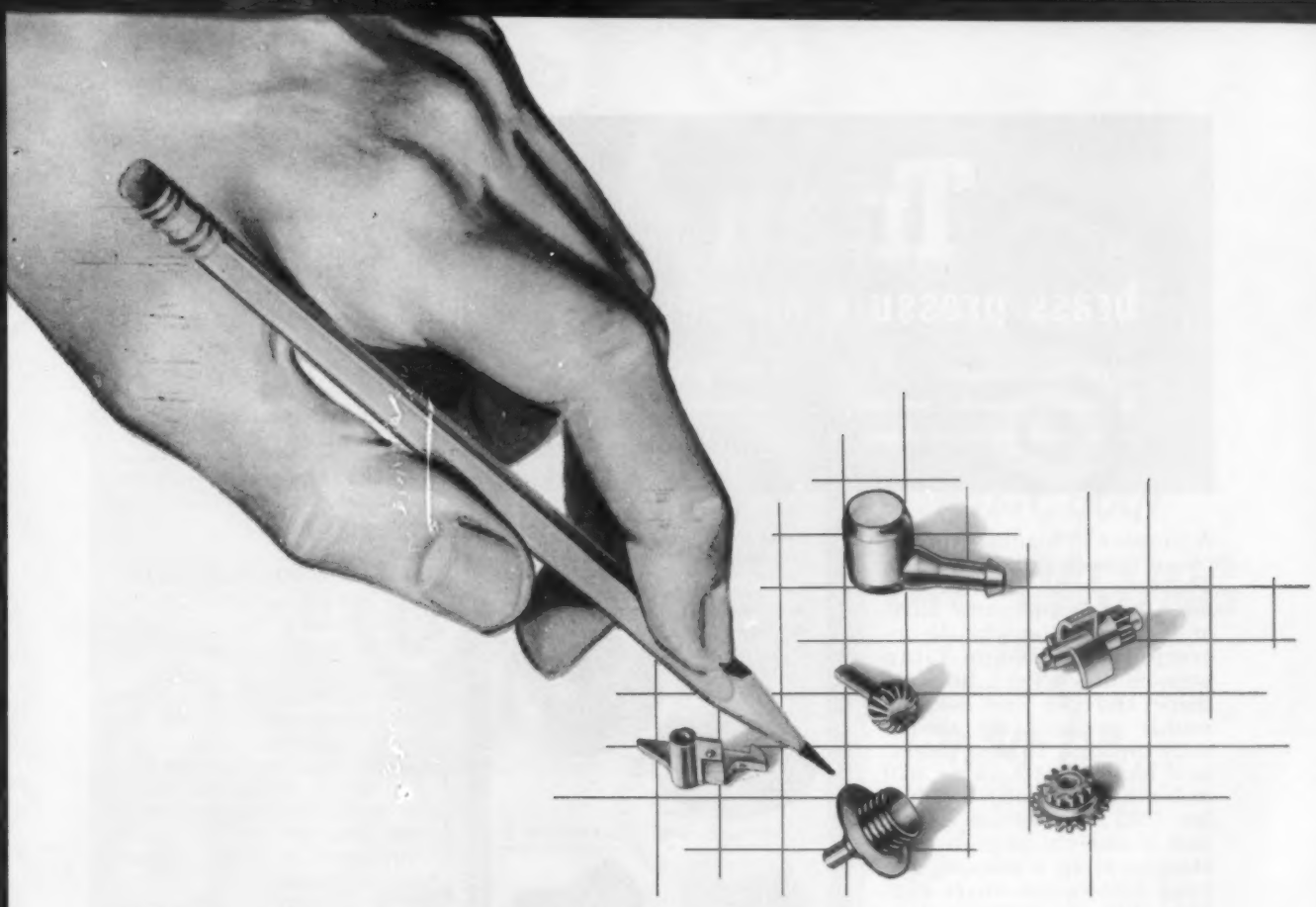

GRC's small parts are doing a **big job** for industry:

helping product planners improve design while substantially reducing costs.

Yes, almost any industry you can name is benefiting from Gries' unusual small parts' manufacturing methods. Exclusive GRC patented techniques and specialized machinery are giving design engineers wider latitude in their plans, enabling them to solve hitherto "impossible" parts problems, and to take advantage of many time- and money-saving short cuts. Broadly, GRC offers facilities for custom diecasting and plastic-molding of tiny parts; whichever the method, each part is engineered and manufactured to do its job better, because it is made better — at less cost.

GRC SPECIALIZED DIECASTING

Mass-produced in quantities from 100,000 to many millions, GRC's corrosion resistant zinc-alloy small parts are diecast in one automatic operation, completely trimmed and ready for use. Smallness and intricacy are unlimited — maximum length 1¾", weight up to ½ oz. Cost you less, because welding, scrape loss, expensive tools, machining, and assembly are eliminated or reduced — design is simplified. GRC has complete facilities for low-cost secondary machining and finishing.

GRC'S EXCLUSIVE INTERCAST PROCESS gives you completely *cast-assembled* small parts in single units or continuously interlocked assemblies. Maximum unit length 1½", maximum weight ½ oz.

GRC INJECTION PLASTIC MOLDING

Parts up to .03 oz. in weight and 1¼" long are economically molded of nylon or any other thermoplastic. Gries' unique molding technique minimizes shrinkage problems of nylon and makes the most of its important mechanical and electrical properties.

AUTOMATIC INSERT MOLDING. Gries has exclusive facilities for molding individual inserts and molding plastic elements on continuous inserts, such as wire, cord, etc.

GRC INDUSTRIAL FASTENERS

A complete line of zinc-alloy diecast wing nuts, cap nuts, thumb nuts, wing screws, rivets; stocked for immediate delivery in any quantity. Rustproof, accurate, and durable, in plain bright and all commercial finishes.

GRC STANDARD PARTS

A large variety of zinc-alloy diecast standard and specialized components for open-stock orders. Includes such items as gears, pinions, rings, buckles, and thousands of components for all industry — all of the same quality and finishes as GRC fasteners.

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- ☐ Small Parts Plastic Molding
- ☐ Industrial Fasteners
- ☐ Stock Sheet — Gear & Pinions
- ☐ Standard Products

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World's Foremost Producer of Small Diecastings • 157 Beechwood Ave., New Rochelle, N. Y. • NEw Rochelle 3-8600

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Titan

brass pressure die castings

- cut fabrication costs
- simplify secondary machining
- are made in complex shapes
- have consistent uniformity
- allow large weight savings
- increase production rates

A pioneer in manufacture of brass pressure die castings, Titan can supply these parts to meet your requirements. Little or no secondary machining operation is needed on Titan pressure die castings. Intricate shapes and deep cored holes are readily produced, are consistently uniform. To save weight, wall sections as thin as .070 inches are generally feasible; but 1/32 inch section is possible if not too large in area. Machine scrap is reduced, and your fabrication costs cut. Moreover, the better surface finish, sharper outlines, greater accuracy, higher strength, and finer grain structure of Titan brass pressure die castings make them unquestionably superior to sand and other types of castings.

Anyone of these versatile advantages may be reason enough to specify Titan brass pressure die castings as components in your finished product. Find out what Titan can do for you.

Send for 12-page booklet on Titan brass pressure die castings

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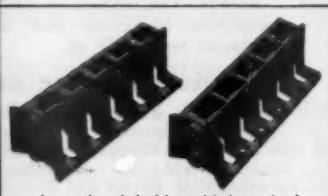
VISUAL PROOF

These photos demonstrate how little secondary machining is required on typical Titan pressure die castings. In each case a part as cast and trimmed only, and the same part machined are shown.

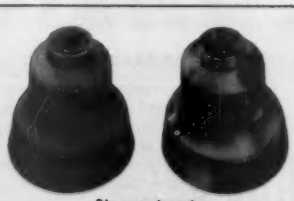
Flywheel for garbage disposal unit

Small brush holder



Large brush holder with broached holes held to close tolerance

Overflow plate and trip handle



Shower head

PMM LETTERS

the readers' forum

PERMANENT MOLD FOUNDRIES

We would appreciate your forwarding a list of companies who are doing permanent mold casting. We are interested in brasses or bronzes and not aluminum.—L.R.H. (Chief Engineer)

Names of a number of permanent mold foundries have been sent.—Ed.

WATER SOLUBLE WAXES

In the July edition of Precision Metal Molding, you ran a feature article on water soluble wax cores.

Since we are associated with gold manufacture in many ways, including casting, gold weight is an important material cost factor. The soluble wax cores will help us, we feel, in bringing down this cost. May we have all available information in regard to water soluble waxes.—J.S.

Names of companies interested in promoting these waxes have been furnished. Also, see the article beginning on page 54 of this issue for ideas about using soluble wax.—Ed.

CONTINUOUS MELTING

In the November issue of Precision Metal Molding magazine on page 60 you have an article entitled "Permanent Mold Castings Can Be Used For Long Runs." You refer in this article to Continuous Melting and Automatic Pouring, PMM Sept. 1955, page 109. Would you have a copy of this referred to article?—W.N.F.—(Sales Manager)

Information sent—Ed.

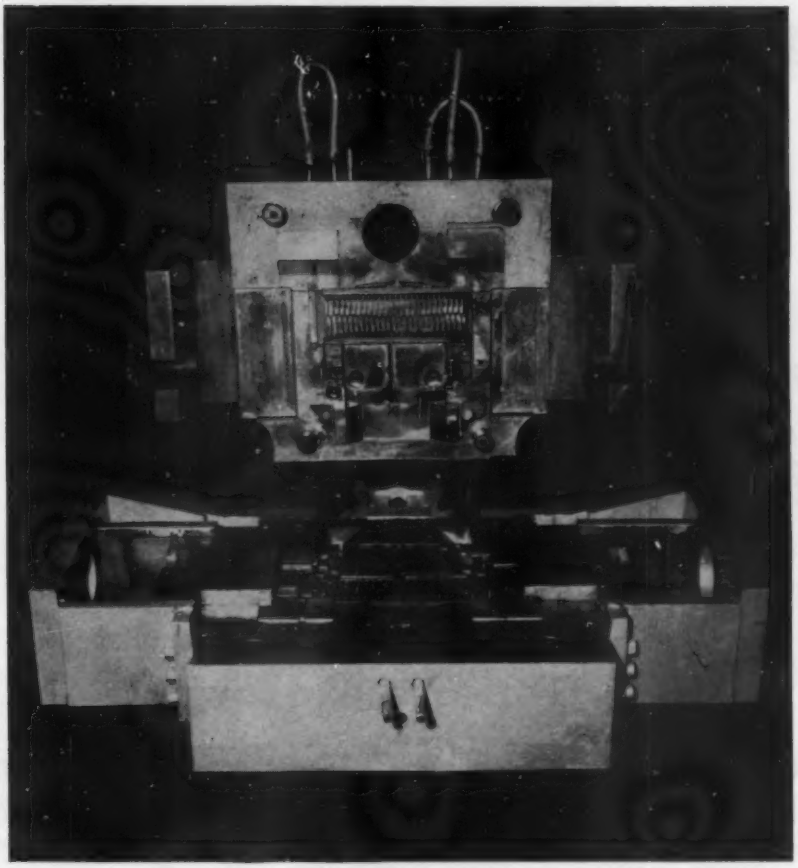
TEST BARS

I noticed on page 110 of the November, 1956 issue of "Precision Metal Molding" that the Investment Casting Institute has approved a standard test bar.

Since we are users of such castings a sketch of this bar would be appreciated.—R.E.S. (Chief Metallurgist)

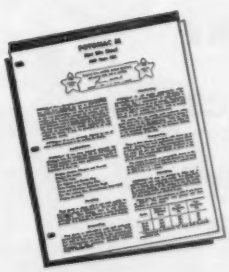
Information regarding all ICI standards and tentative standards can be secured from the Investment Casting Institute, 27 W. Monroe, Chicago, Ill.—Ed.

For more information circle No. 107 on the Reader Service Card



No matter what your DIE-CASTING JOB may be...

Accuracy calls for POTOMAC M Hot Work Die Steel



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and others...

Such patronage must be deserved

THE NEW ENGLAND DIE CASTING CO.

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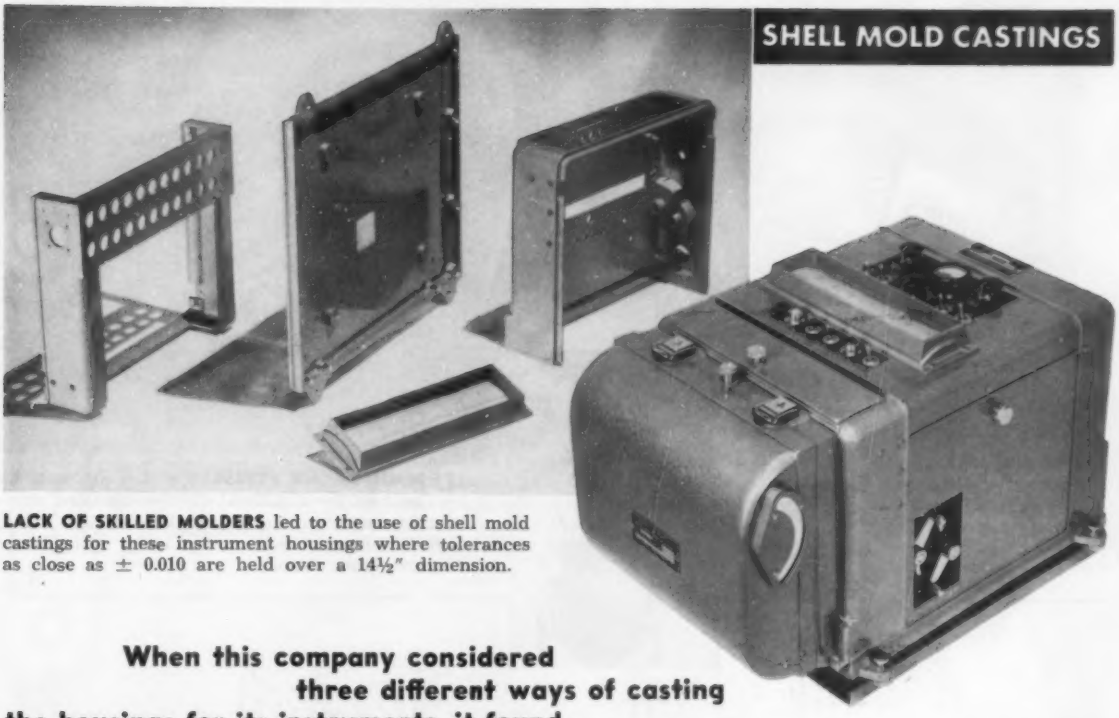


LACK OF SKILLED MOLDERS led to the use of shell mold castings for these instrument housings where tolerances as close as ± 0.010 are held over a 14½" dimension.

When this company considered three different ways of casting the housings for its instruments, it found . . .

Labor Shortages And Plant Space Influence Casting Choice

ALMOST by definition, the shell mold process for the production of castings requires that a large number of duplicate parts be made to achieve the economies generally reported. These economies come about largely through the use of unskilled labor on the molding floor and the elimination of subsequent machine operations.

Almost every step in the making of shell molds is more expensive than the corresponding step in making green sand molds — with the single exception of wage rates for operators. No figures can be given which would show a sharp division, economically, between green sand molds and shell molds; too many factors can enter that are peculiar to a particular industry or geographical area.

As an example, consider the Model S-20 Oscillograph made by the Hathaway Instrument Div. of Hamilton Watch Co. in Denver, Colorado. This instrument is illustrated above, along with some of the case and housing castings.

While this instrument is built in fairly large numbers it is far from being a mass produced item. Normally the castings shown (and two others not illustrated) would be produced from green sand molds and fully machined; they are, however, cast in shell molds. The question is: Why?

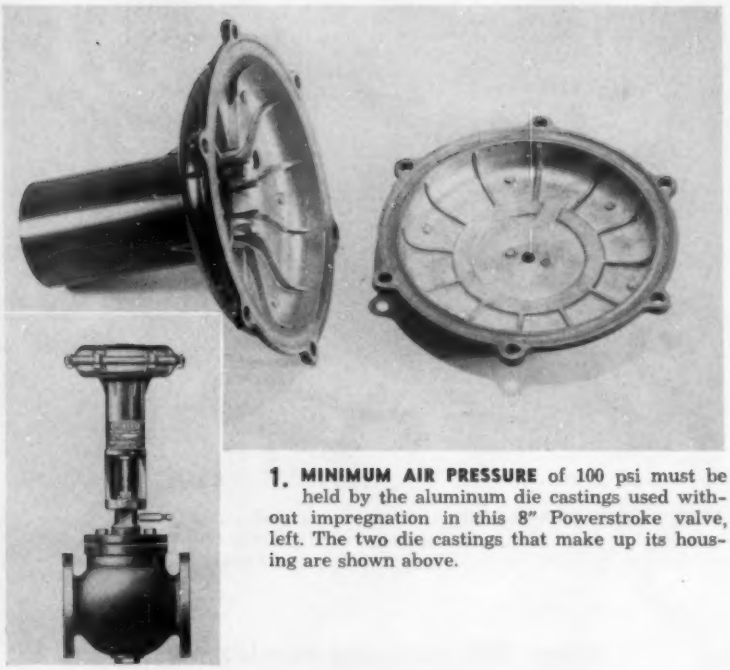
The largest of these aluminum castings is the base — about 14½" x 11½". Certain dimensions must be held to within ± 0.010 over the entire length of 14½" and others of lesser length to proportionately close tolerances. The surface must be good enough to give a smooth finish when one coat of hammered type baked enamel is applied.

If ordinary job-shop produced sand castings were used they would have to be machined all over to secure the perfection of surface that is required. Dimensionally, they would be poor, requiring a considerable amount of machining to bring the parts within requirements.

When this instrument was designed and production methods considered, a precision sand foundry being operated by the company was quite capable of making the castings to the drawing specifications. Further, conditions within the present plant were badly crowded and, in spite of planning then going on for newer

Continued on page 95

COVER STORY



1. **MINIMUM AIR PRESSURE** of 100 psi must be held by the aluminum die castings used without impregnation in this 8" Powerstroke valve, left. The two die castings that make up its housing are shown above.

Specification: Pressure-Tight Castings

By DAVID H. THORBURN, Chief Engineer
Powers Regulator Co.

STARTING with a simple valve handle, die cast in zinc, some nine or ten years ago, the use of both zinc and aluminum die castings by the Powers Regulator Co. has grown steadily. While the full potentialities of the die casting process have not yet been realized, today there are 19 different castings in active production and at least 6 more that are in the design or tooling stages, while the original valve handle is still a production item.

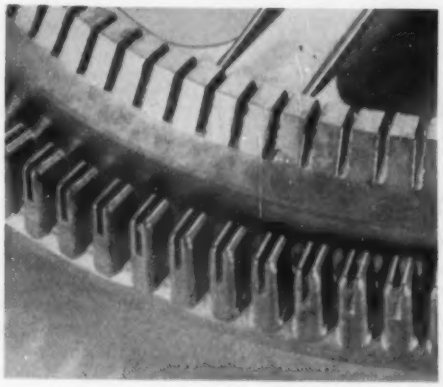
The steady increase in use of die castings can be traced quite readily to some two or three specific factors. The steady improvement in the quality of die castable alloys, particularly aluminum base alloys, has been one factor. The availability of dependable data on the physical and mechanical properties of die cast metals, in the cast condition, has also contributed. Finally, and perhaps most importantly, the ability to produce nonporus aluminum castings that can be used at 90 to 100 psi or more air pressure, without impregnation, has opened one complete field of application in this company that heretofore had to be closed to die castings.

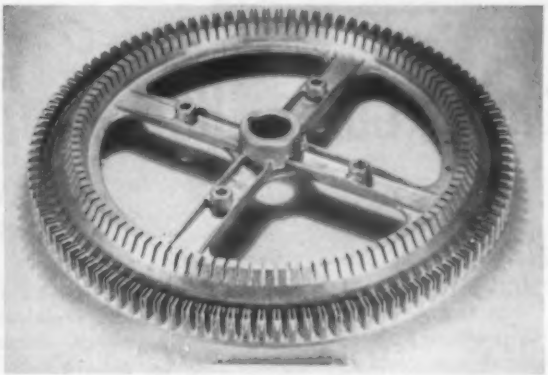
On the other hand, there are still some parts that are now made as either grey iron castings or machined from wrought stock that could readily be converted to die castings if more mechanical data were available; at least one such part will be discussed below.

In the listing of reasons for the increased use of die castings given above, the point was noted that some foundries, at least, can produce pressure tight castings. How such castings are applied, why they are needed and how they are being produced can be illustrated by the 8" Powerstroke. This unit, shown in Figure 1, is an air actuated valve motor in which air, at test pressures up to 90 psi, is contained in the upper housing. Variations in air pressure actuate a diaphragm which, in turn, operates the valve.

Since this type of valve can be used for proportioning as well as for full on or off operation, it is imperative that, when a setting is achieved, there be no drop in air pressure, due to leakage, that would upset the steady-state that has been achieved.

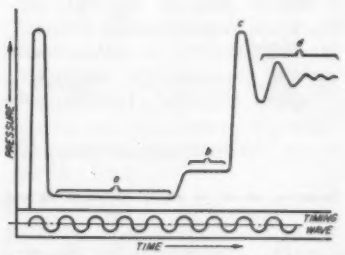
For service of this type, impregnation of a porous casting would seem to be the logical answer. However, the cost of impregnation, plus the cost of the 100 percent inspection of the castings that would be absolutely essential, would nullify all of the cost advantages that are gained through



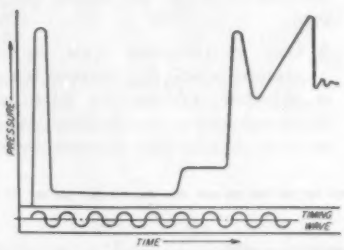


CASTING TECHNIQUE ELIMINATES MILLING OPERATION

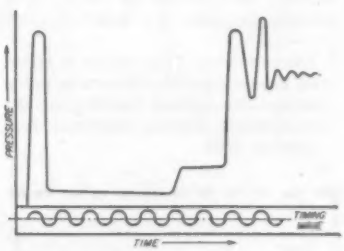
IMPACT CASTING gives a noticeable improvement in die fill. The selector wheel for a record changer, shown above, could not be economically made by normal casting methods due to failure to fill the small rings properly. Now, adequate fill is secured as shown by the enlarged view (left). Rejects due to improper die fill are now considerably below one percent.



2. SINGLE INJECTION die casting. Peak pressure at "d" is after complete injection of metal has occured and solidification ready to start. Entrapped air is retained.



3. DOUBLE INJECTION as normally applied. When the second pressure peak has been reached solidification is too far advanced. Entrapped air is compressed, but retained.



4. IMPACT INJECTION die casting. The second pressure peak is secured almost instantaneously so that little or no solidification has occured. Entrapped air can be removed.

the use of die castings.

There would still be advantages to the use of die castings that might outweigh even this loss of cost advantage, but here the basic policy of the Powers Regulator Co. enters into the considerations. Management would not approve the use of any parts which, in their opinion, represented an attempt to salvage an otherwise unusable piece. Therefore, if die castings showed a tendency to leak air, the older cast iron housing would continue in use.

Consultations with different producers of aluminum die castings determined that at least one foundry has a method of producing parts that will give substantially 100 percent non-porous castings at the required test pressure. An added advantage of this casting method is that the physical and mechanical properties of castings made by this method are somewhat higher than normal, production-run die castings in the same alloy.

This method of casting as developed by Carl Roehri, president, Federal Die Casting Co., has been given the generic name of impact die casting.

Impact Casting

Under normal methods of producing aluminum die castings, when the shot is made, the injection plunger forces the metal into the die at a high rate of speed, but at a relatively low pressure (Section a, Figure 2). As the die is filled, the pressure rises rapidly to some maximum, depending upon the particular machine, and then starts to drop (Section b and c of Figure 2). Finally, as the casting solidifies in the die with pressure still applied giving a time pressure curve as shown (Section d of Figure 2).

If at some time after peak pressure is achieved, a second application of pressure be given that is equal to, or higher than, the first peak, a small additional amount of metal can be forced into the die cavity, providing the second application of pressure takes place prior to metal solidification. This additional metal can only be accommodated by displacement of the entrapped air in the cavity.

This two stage injection is based upon the well known formula for work or energy: i.e., $E = \frac{1}{2}mv^2$ Since, in a die casting operation, it is not possible, in a practical manner, to increase the mass and further, since doubling the velocity will give an increase in ener-

Continued on page 108

INVESTMENT CASTINGS

Soluble Cores: How And Where Used

By **CHARLES W. SCHWARTZ,** Technical Director
Misco Precision Casting Co.

WHEN design engineers concoct shapes that are difficult to produce by conventional machine shop or casting methods, their first thought is to turn to investment casting. This is particularly true of hollow shapes, a type of component with which investment casting has been especially successful.

The fact is, however, that some of these hollow shapes are also difficult to produce by investment casting because the interior configuration is such that the core cannot be withdrawn from the wax pattern. Some ingenious methods have been developed to solve the problem of the pattern with the non-retractable core:

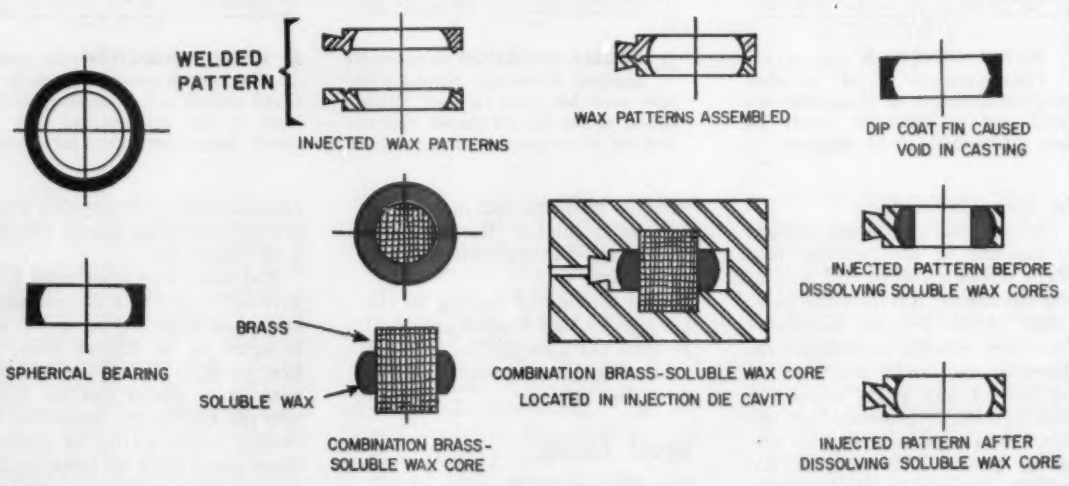
1. Split section retractable metal cores.
2. Split section patterns which are fixture-welded or cemented to form the whole pattern,
3. Use of soluble wax cores around which the pattern wax is injected. (After the core is dissolved away, the hollow pattern is ready for processing.)

The split section retractable metal core usually causes trouble because of wax flash into the section parting lines. However, in most cases the flash can be hand trimmed from the passage in the pattern, and this condition is not of major importance in evaluating these techniques. This method is also generally used only on straight machined sections.

Where difficult internal contours are encountered it is usually impossible to satisfactorily section the core for removal. Another frequent trouble spot

Continued on page 120

* *Editor's Note:* This article is based on a paper by Mr. Schwartz given before the annual meeting of the Investment Casting Institute, November 1956.


WELDED PATTERN
INJECTED WAX PATTERNS
WAX PATTERNS ASSEMBLED
DIP COAT FIN CAUSED VOID IN CASTING
SPHERICAL BEARING
BRASS
SOLUBLE WAX
COMBINATION BRASS-SOLUBLE WAX CORE
COMBINATION BRASS-SOLUBLE WAX CORE LOCATED IN INJECTION DIE CAVITY
INJECTED PATTERN BEFORE DISSOLVING SOLUBLE WAX CORES
INJECTED PATTERN AFTER DISSOLVING SOLUBLE WAX CORE

1. **SPHERICAL BEARING** was first produced using a 2-piece wax pattern, cemented at the joint and wax-welded on the outer surfaces. Inside spherical surface was very critical and no welding or excess cement could be tolerated. Many thousands of these castings were produced this way but difficulties were met because of the crack at the parting line. Perfect cementing could not be obtained and the dip coat would penetrate into the crack. This would ultimately result in a deep crack-like line in the casting at this point and would also cause further trouble in that the thin dip coat layer would flake off into the cavity and cause inclusions in the finished part. It was then decided to change to the soluble wax technique. The soluble wax was injected around a brass insert and then the core assembly was located in the pattern injection cavity. Normal injection procedures followed by water solution of the soluble core produced a satisfactory pattern and a satisfactory casting. Parting lines were eliminated resulting in lower casting scrap rate and better surface finish.

FIVE STEPS IN MAKING A PATTERN WITH SOLUBLE CORE

2. AIR FOIL casting is a typical use for soluble wax core.

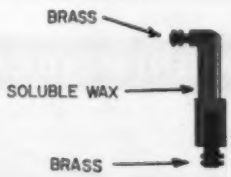
Soluble wax core with brass core prints is ready for pattern.

Soluble wax core located in injection die cavity.

Injected pattern before dissolving the soluble wax core.

Injected pattern after dissolving the soluble wax core.

PLUMBING CASTING IS A TYPICAL USE FOR SOLUBLE CORES



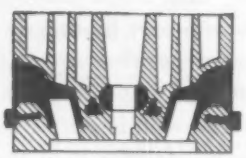
3. BRASS CORE PRINTS locate the soluble wax in the die cavity when forming this typical aircraft plumbing type casting. Hollow sections in this type of casting used to carry fuel, oil, etc. as engine accessory parts, are often quite complex. Brass core prints reduce the amount of soluble wax needed and also provide the initial cavity which speeds water solution of the soluble core.

COMPLEX INTERIOR USING SIX SOLUBLE CORES

4. SIX SOLUBLE CORES and many brass inserts were used in making the complex pattern for this cylinder head for a diesel engine. The four ports for the exhaust and intake manifolds and the hollow cooling chamber located radially around the lower section of the ports make this a complex piece. To further complicate it, a spherical inner precombustion chamber is located in the center of the casting. Considerable development work was required to perfect this casting, but the success of the project contributed greatly to the success of the engine on which it was used.

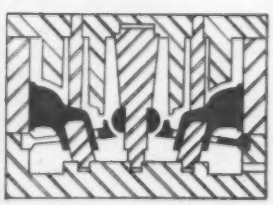
SOLUBLE WAX CORES

A



INJECTED PATTERN BEFORE DISSOLVING SOLUBLE WAX CORE

C



SOLUBLE WAX CORES LOCATED IN INJECTION DIE CAVITY

B

INJECTED PATTERN AFTER DISSOLVING SOLUBLE WAX CORE

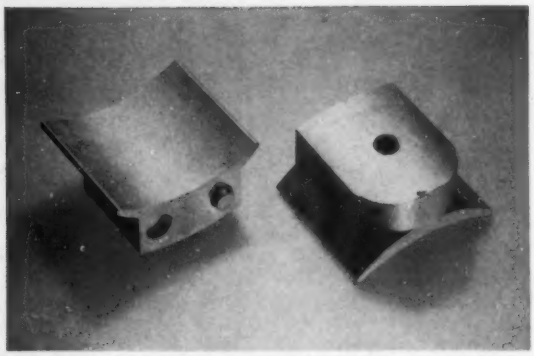
D

Each of the PMM processes offers a number of special advantages that you should consider . . .

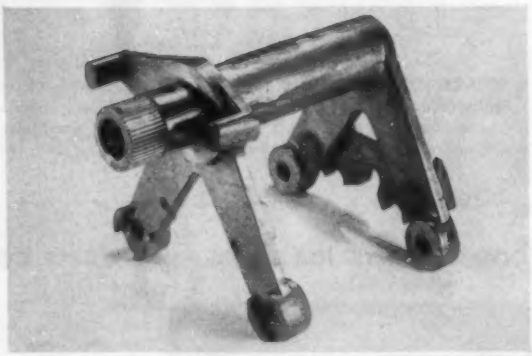
When You "Shop" For An Improved Manufacturing Method

This manufacturer of materials handling equipment has made use of certain specific advantages of three PMM processes. Sometimes the choice is indicated by unique physical properties, while other decisions come about because of a favorable cost situation, the ability to form a complex shape with moderate tooling costs, or some other such consideration. Here are three typical examples of the underlying thinking behind such decisions.

POWDER METALLURGY



PERMANENT MOLD CASTINGS



PLASTER MOLD CASTINGS

SINCE pole pieces for direct current motors may be either solid or laminated, the choice becomes one of manufacturing economy only. Until recently, Automatic Transportation Company used laminated pole pieces exclusively. This company has found, however, that in at least two sizes of motors, overall manufacturing saving of 15 to 20 percent can be realized by using pole pieces molded from iron powders.

Of course, not every iron powder will give the desirable magnetic properties when pressed and sintered. With a judicious choice of a powder mixture, the Powdered Metal Products Division of Yale & Towne Mfg. Co. has found that almost any desired properties can be obtained.

In making the pole pieces of laminations, several disadvantages were apparent. Tooling was quite expensive since duplicate sets of tools had to be made so that one set would be in use while the other was being redressed. If a shaving operation was not used (and on thin stock this is most difficult and expensive) some burrs would be formed which had to be removed prior to assembly of the stack.

Since it is out of the question to punch out gradually decreasing sizes of laminations to secure a rounded corner on the stack, a cap had to be fashioned for each end and assembled onto the group of punchings to prevent damaging the insulation of the stator windings. This, is an added expense item and a source of rejected motors where the insulation became cut in spite of the protective metal caps.

Assembly of the laminated pole pieces had to be done in jigs (the two sizes used differ only in length) and the stacks when built up to the proper length were riveted together. Here again, variations as small as a single lamination could vary the pole piece

Continued on 64

IN the majority of machine components, the design is such that a plurality of manufacturing methods are possible so that some "shopping around" can be done to determine the most economical. Some parts, however, must have a rigidly fixed design which is such that the choice of manufacturing methods is severely limited. A component in this latter category is the switch gear part used by the Automatic Transportation Company.

Because of the functions it must perform, the controller arm, show at the left, allowed little design latitude. A casting or an assembly of machined and welded components were the only manufacturing choices possible.

When relative costs were determined, it soon became evident that to make the parts of individual components and weld them together would be far too costly so that the final choice lay between a sand casting and a permanent mold casting. Since the material to be used was an aluminum bronze, either method was equally satisfactory from a casting standpoint. However, a sand casting could not give the amount of detail that a permanent mold casting would give. Further, many of the surfaces had to be smooth enough so that overall machining of a sand casting would have been required.

When extra machining costs, over and above those required on a permanent mold casting, were added to initial tooling costs and per piece cost of the castings, it became evident that permanent mold castings would be the most economical.

In spite of the high degree of precision possible in a permanent mold casting, it is still necessary to do a great amount of machining on this part. In the casting of this controller arm, only the center hole through the hub is cored; all others must be drilled.

Continued on page 121

WHENEVER possible, motor manufacturers use die cast aluminum fans for cooling. The wide design latitude possible, the low piece costs and the excellent surface and accuracy possible when die casting is used all contribute to lower cost, more efficient motors.

Die casting of fans for motors does have, however, some disadvantages under certain conditions. While the design is still fluid, the cost of both initial tooling and tool modification is high. When production is limited, piece costs due to high set-up charges and high tooling charges may make the piece costs excessive. Under these latter conditions, some other method of fabrication is generally better and often plaster mold casting is one of the best answers.

With a plaster mold casting, surface finish and dimensional accuracy closely approach normal die castings. The initial pattern costs are relatively low and patterns can be modified quickly and easily so that changes can be made at low cost. Set-up charges for this method of casting are very low, so that for limited production there is not this added cost factor. Further, the absence of rigid cores permits shapes that are not possible in either die casting or full permanent mold casting.

The motor fan, shown at the left and used by the Automatic Transportation Company illustrates many of the advantages of plaster mold casting.

It must be recognized that this fan does not represent the final casting as it will be made. Rather, it shows how an initial casting has been slowly modified until a desirable design is achieved that can be produced economically as a plaster mold casting.

The major fan part is a plaster mold casting in aluminum on which a extensive machining has been done. The part is supplied by the vendor, The Aluminum Company of America, with only the large hole in the hub cored. All smaller holes must be drilled and the step on the fan blades that receive the shroud ring are machined.

While the amount of machining

Continued on page 96

4 reasons besides cost and design to use die castings

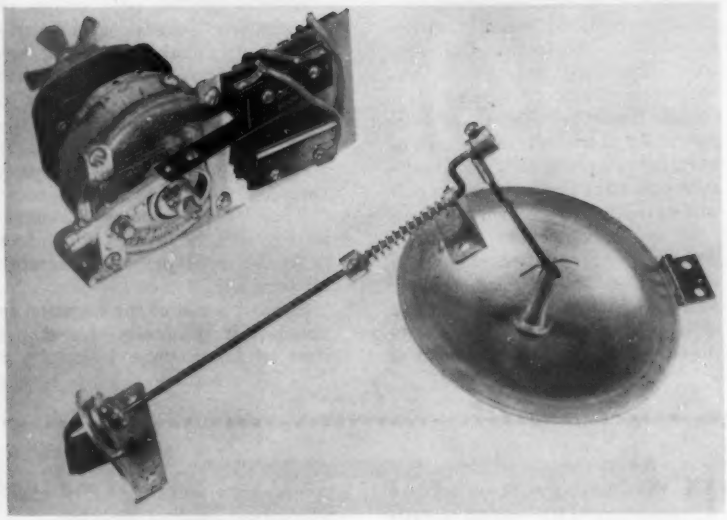
When you buy die castings, the apparent piece savings may be less significant than your savings in . . .

CAPITAL INVESTMENT in special machine tools. Even though a machine tool may be amortized over a period of from seven to ten years, and in some cases even longer, the initial investment required can be a distinct burden.

FLOOR SPACE. Today, with the prevalent high tax structure and the excessive costs of buildings, manufacturing establishments tend to compress their activities into as small an area as is consistent with economical production. In many cases, the addition of one or more new machines or operations can bring about a condition where existing operations become too cramped for economical production or new buildings are needed.

LARGER INVENTORIES. Through the use of processes other than die castings, inventories must be carried on both raw materials and on finished parts, assuming that manufacturing operations are set up so that no semi-finished parts need to be stocked. Allied to increased inventories is the problem of raw materials purchase and inspection, storage space for greater volumes of materials, plural inspections during manufacture and disposition of machining scrap.

PERSONNEL. New and enlarged manufacturing operations must always carry with them increases in the number of employees. While this factor, in itself, may not be at all serious in good labor markets, the increased load on supervisory, clerical and inspection staffs invariably increases the non-productive overhead charges.



1. LITTLE IN-PLANT PROCESSING is needed by die castings used in these ventilators for incubators. These secondary advantages have led company engineers to report that . . .

Cost And Design Factors Are Only Half The Story

By WILLIAM R. HOOVER, Chief Engineer
Robbins Incubator Company

THE decision to use or not to use die castings is generally dictated by the final per piece cost of a given part. But there can be many other cogent reasons for using die castings. These may be sufficiently compelling to justify the use of die castings even when the per piece cost of the finished part is slightly higher as die cast.

Reasons which might influence such a choice are listed at the left.

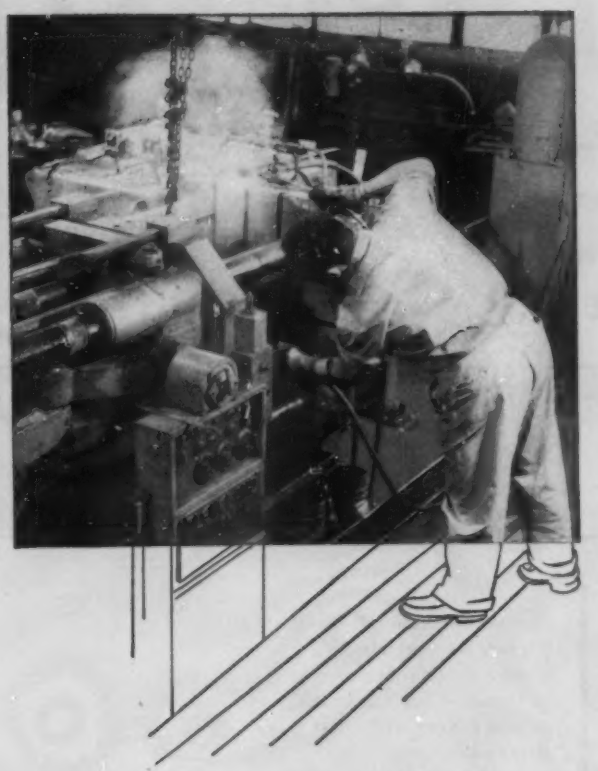
For some of these general reasons the Robbins Incubator Co. utilizes a number of zinc base die castings in both manual and automatic ventilators; these two units, partially assembled, are shown in Figure 1.

Five zinc die castings, Figure 2, are used in the manual ventilator. All of these castings represent original die cast design and all are designed so that the only operations necessary after casting and trimming are simple drilling and tapping.

The clevis, Figure 2, requires only tapping of the blind, cored hole while the ratchet plate and the support bracket require drilling only. Due to the relatively light usage of the ratchet and ratchet plate, the detents and probe can be formed in the casting operation and have shown little, if any, wear over a period of years of constant usage. The pedestal, is used on both types of ventilators. As

Continued on page 70

dag **'dag' dispersions... *a touch does so much!***



'Aquadag' Cuts Rejects 30%

—*reports Bendix*

"Surface folds, gas-induced porosity and other causes for excessive rejects of die-cast turbine blades and aluminum air speed indicator frames were eliminated by the use of **'Aquadag'**, states a report from the Die Casting Department of Bendix Foundries.

'Aquadag', a dispersion of colloidal graphite in water, is sprayed over all die surfaces and recessed areas in 2-3 seconds, with die at least 250 Deg. F. The water completely evaporates before the die is closed, leaving a tough film which the molten metal will not volatilize. As a result, parts are cast to closer tolerances and with finer finish. There are no gummy deposits on dies, no build-up in recessed corners and no gaseous effects to weaken the casting. And, of course, water does not produce toxic fumes.

Frequently, one application of **'Aquadag'** lasts for 10 or more cycles. In other words, at Bendix Foundries, **'Aquadag'** helps produce superior, more uniform castings at substantial savings of time and money.

Write for Acheson Bulletin 425 on Metal Casting Operations for practical information on product improvement and lower costs in your own shop. The Acheson Service Engineer in your area will be glad to consult with you.

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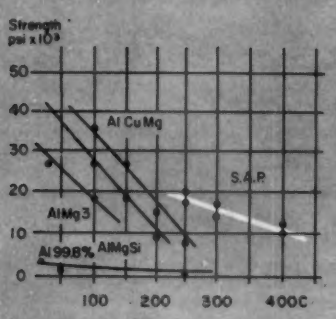
For more information circle No. 2 on the Reader Service Card

1. **PROPERTIES OF S.A.P. COMPARED** with pure aluminum and Y-alloy.	Fabrication	Billet	Quality	Yield ——— strength 20° C psi x 10^3	400°C psi x 10^3
a	Melt	Pure Al cast	Extruded	5.7	1.4
b	Melt	Y-alloy cast	Extruded	11.4	3.6
			Heat-treated	40	3.6
c	atomized powder	Pure Al sintered	Extruded	17	4.3
d	milled powder	S.A.P. Pure Al sintered	Extruded	37	19.6

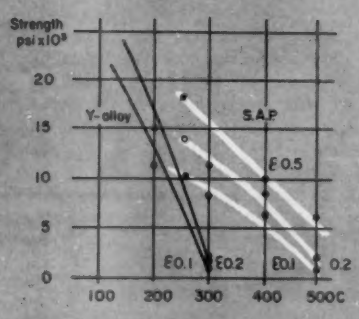
A Guide To Using S. A. P.

Sintered Aluminum Powder is a new material with a range of useful engineering properties. What it is, how it can be applied in your designs, and where it has already been used are reported here by its developer.

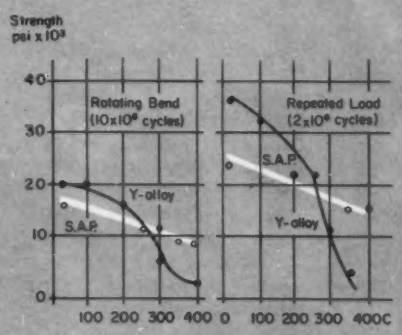
MECHANICAL PROPERTIES OF S.A.P.



2. Creep-Rupture properties of S.A.P. and aluminum alloys.



3. Creep Of S.A.P. and Y-alloy; permanent deformation „ε" for 1000 hours at temperatures.



4. Fatigue Strength of S.A.P. and Y-alloy in psi x 10^3.

By R. IRMANN,
Neuhausen, Switzerland

WHAT IS S.A.P.? S.A.P. is an abbreviation for sintered aluminum powder, a new material which with regard to its components aluminum-alumina could be classified as a "Cermet". It was invented at the Research Laboratories of the Aluminum-Industrie-Aktien-Gesellschaft at Neuhausen, Switzerland, and has aroused wide interest in industrial and scientific circles.*

S.A.P. is manufactured from extremely fine, pure aluminum powder and has the same strength at room temperature as heat-treated aluminum alloys. It does not lose this strength property even when heated for long periods up to temperatures of approximately 500 C. At 400 C, for instance, it shows five times the strength of aluminum alloys.

Among its other special properties it has the corrosion resistance of pure aluminum, and has higher thermal and electrical conductivity and lower thermal expansion than aluminum alloys.

WHAT PRODUCTS are manufactured in S.A.P.? Forms produced in this material include: bars and sections, tubes, sheets and forgings.

Pure aluminum powder with a particle thickness of a few 1/10 μ and an oxide content of up to approximately 15 percent formed during the manufacturing process, is cold compressed, hot-pressed and subsequently extruded.

Use is made of a powder of high apparent density, covered by patents. Bars, sections and tubes can be produced in this manner. Sheets are rolled from extruded billets. For hammer forged parts and drop-forgings, in general, extruded bars are used.

The properties of S.A.P. cannot be obtained with coarser powders, such as atomized powder.

MECHANICAL PROPERTIES Figure 1 shows the mechanical properties of pure aluminum and the heat-resistant aluminum Y alloy manufactured from cast billets by extruding, and also the properties of sintered material produced from atomized coarse powder and S.A.P. from fine powder. The 0.2 percent offset yield stress was taken as a measure for strength.

Pure aluminum (a) shows a low yield stress at room temperature, this feature being especially marked at higher temperatures, such as 400 C.

The heat-resistant Y alloy shows a yield stress twice the respective value of pure aluminum, both at room temperature and 400 C (b).

The yield stress of heat-treated Y alloy is several times that of the same alloy when extruded. For instance, after heating up to 400 C for 100 hours, tests at this temperature show that the yield strength drops back to the value of the non-heat-treated Y alloy.

When a so-called "atomized" powder is produced from pure aluminum (c) with particle sizes from approximate 10 to 50 μ by atomizing it in its liquid state, with subsequent cold-compressing, hot-compressing and sintering, it shows in its extruded state three times the yield stress value of extruded pure aluminum (a), at room temperatures and 400 C.

Very fine pure aluminum powder (d) manufactured by ball milling, with particle thickness of a few tenths micron, compressed, sintered and extruded as above, gives about the same yield stress as heat-treated Y alloy at room temperature and about five times the value of this alloy at 400 C.

A heat resistant material becomes of real interest only in the higher temperature ranges and under prolonged strain. These properties may be represented by the rupture stress corresponding to various times and various temperatures or, even better, by the rate of permanent deformation rate during prolonged strain.

Creep rupture strength at various times for S.A.P., pure aluminum and heat treated aluminum alloys

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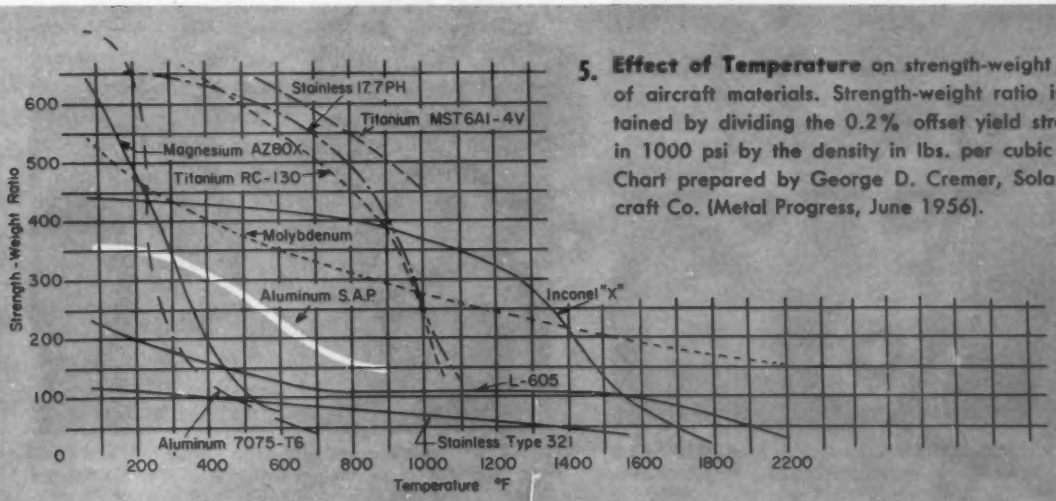
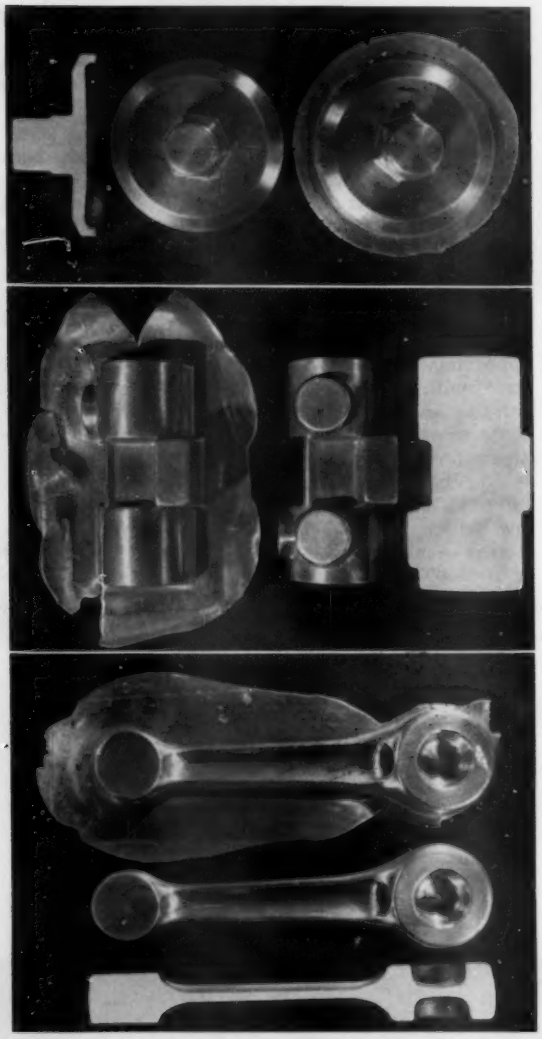
*U.S. patents and patents pending



5. Effect of Temperature on strength-weight ratio of aircraft materials. Strength-weight ratio is obtained by dividing the 0.2% offset yield strength in 1000 psi by the density in lbs. per cubic inch. Chart prepared by George D. Cremer, Solar Aircraft Co. (Metal Progress, June 1956).

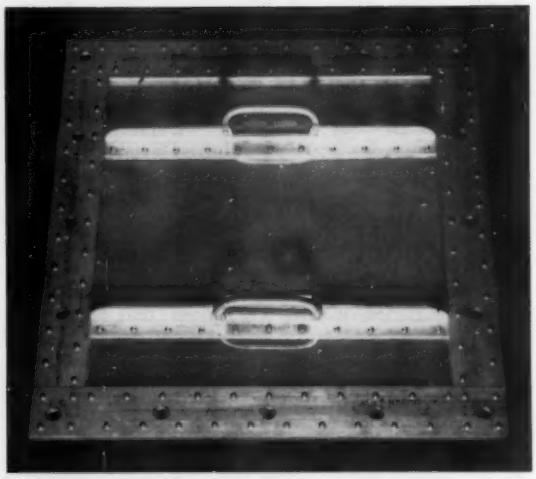
WHERE S. A. P. IS BEING USED

In Europe, S.A.P. is being used in production as the starting point for manufacturing many different products. Here are some of the outstanding current examples.

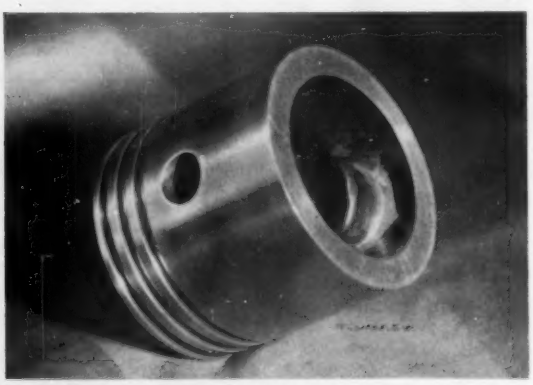


6. DROP FORGINGS made from S.A.P. material indicate some of the design possibilities. Note untrimmed pieces.

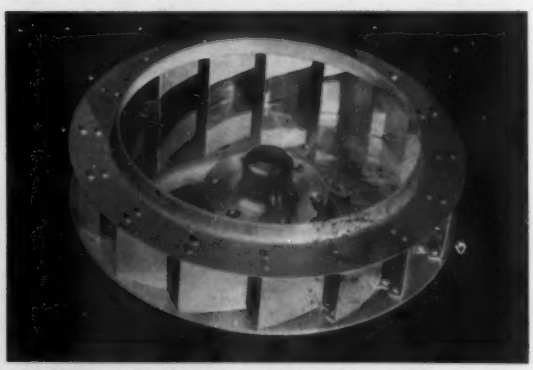
7. COMPRESSOR BLADES drop forged from S.A.P. bars offer an interesting approach. Blading may be stress relieved prior to surfacing without loss of strength.



8. MANHOLE COVER for an exhaust gas conduit uses S.A.P. sheet sections and rivets. Special properties at 250 C influenced this choice of materials.



9. FORGED PISTONS and cylinder heads can be made starting with aluminum powder. Again, special properties are obtained.



10. DEEP DRAWN outer ring, drop forged hub and sheet blades make up the construction of this riveted hot air circulating fan.

PROPERTIES OF S.A.P.

Electrical Conductivity at 20 C 44 to 49 (copper = 100)
Thermal Conductivity at 20 to 500 C 0.41 CGS units

Chemical Properties: Corrosion resistance corresponds to that of pure aluminum (99.5%)

Coefficient of Thermal Expansion

Temperature (°C)	Coefficient $\frac{cm}{cm \times °C}$
20-100	20×10^{6}
20-200	21
20-300	21.5
20-400	22
20-500	22.5

Modulus of Elasticity

Temperature (°C)	Ave. value (psi x 10^3)
20	10,700
100	9,400
200	8,400
300	7,200
400	6,600

is shown in Figure 2. The values given for S.A.P. pertain to a 1000 hours' strain and a permanent deformation of 0.5 percent, whereas the values given for the aluminum alloys and pure aluminum were for a 0.5 percent permanent set after a 500 hours' strain only.

The very slope of the curves for S.A.P. shows its completely different temperature dependence despite a double length of straining. Around 200 C already, S.A.P. improves over the values of heat treated AlCuMg.

If the stress is not increased up to the rupture value and if the permanent set is measured after 1000 hours depending on temperature, S.A.P. and Y alloy show the values represented in Figure 3. At 300 C, the stress for a permanent deformation of 0.1 percent is 0.700 psi x 10^3 for heat-treated Y alloy, but 9,100 psi x 10^3 for S.A.P. At approximately 240 C under the same conditions, there is no difference between Y alloy and S.A.P. because the effect of the heat-treatment of Y alloy subsists after 1000 hours.

As under static load, S.A.P. is equally superior to the aluminum alloys under fatigue at high temperatures. Figure 4 shows the rotating bending fatigue strength and the repeated loading fatigue strength at temperatures up to 400 C for S.A.P. in comparison with Y alloy.

For the purpose of comparison between S.A.P., aluminum and magnesium alloys, steel and titanium alloys there are values available on strength-weight ratio by G. D. Cremer, Solar Aircraft Co., San Diego, California.[1] These values are represented in Figure 5. The strength-weight ratio is obtained by dividing the 0.2% offset yield strength in 1000 psi by the density in lb. per cu. in.

Processing Techniques

FORGING. Figure 6a/b/c shows several examples of drop forging. The untrimmed parts give a good idea of the excellent forgeability. Hammer forging may also be performed.

FORMABILITY. Bending of S.A.P. sheet at room temperature requires bend radii of more than five times the sheet thickness. At 400-500 C radii of 2.5 times the sheet thickness may be used.

Deep drawing of S.A.P. sheet at room temperature can be done. For this purpose the English procedure known as "Dyzacking"[2] proved to be of value.

MACHINING. The oxide films contained in S.A.P. act as breakers for the cuttings, so that the machining process yields shorter cuttings than with aluminum alloys. Despite these oxide films, there is no increase in tool wear with S.A.P. The cutting speeds are the same as with aluminum alloys.

GRINDING AND POLISHING. S.A.P. can be processed with the same methods applicable to aluminum alloys.

WELDING. By flash welding, cold pressure welding and hot pressure welding S.A.P. can be bonded with S.A.P., aluminum and aluminum alloys without any appreciable loss in strength. The well known *fusion* welding methods (electric or gas) cannot be applied with S.A.P. on account of its oxide content.

RIVETING. For manufacturing rivets, a special grade of S.A.P. is produced. The riveting operation can be performed at room temperature, better at elevated temperatures. Figure 8 shows a manhole cover for an exhaust gas conduit of a cement factory. Low weight, corrosion resistance and high-temperature strength under service temperatures up to 250 C are required. The cover is made from S.A.P. sheet and S.A.P. sections by riveting. Its dimensions are 725 by 725 mm.

The fan wheel for hot air circulation in Figure 10 has a diameter of 300 mm and works at a service temperature of 400 C. The outer ring of the wheel which can be seen in Figure 10 is deep drawn from a round blank. To this ring and to the plain disk on the back side the fan blades are riveted. The hub is drop forged.

ANODIZING. Anodizing may be performed at a higher voltage than is usually applied with aluminum. It serves in particular to increase resistance to wear.

Applications of S.A.P.

The density of 2.8 kg per cu. decimeter suggests the use of S.A.P. for moving parts. S.A.P. was first used for *compressor blades* which are drop

Continued on page 118

1 "Metal Progress" Vol. 69, No. 6, data sheet, June 1956, p. 80-B.

2 Doyle, W. M., The Properties of Hiduminium 100 (S.A.P.) in Sheet Form. — Sheet Metal Ind. December 1955.

POLE PIECES

continued from page 57

length enough to cause assembly trouble.

The vexations arising from the use of laminations have all been eliminated through the use of pole pieces molded from iron powder and, as mentioned earlier, overall costs have been reduced as much as 15 percent. Disregarding magnetic properties which are equal to those of a laminated pole piece, how were the improvements and savings effected?

A properly designed set of tools, made of the correct material, can be used to mold many hundred thousand pole pieces and, if cemented carbide wear surfaces are provided, will last indefinitely. Thus, one set of tools replaces two sets of punching tools.

Assembly with the accompanying jigs, fixtures, caps, rivets, etc., is also completely eliminated.

The shape of the molded pole pieces can be made to fit precisely the preformed stator winding so that the possibility of ruptured or weakened insulation no longer exists.

The length of the pole pieces can be divided into two classes, inadvertant and deliberate changes. The inadvertant variations may result from having only one lamination more or less per stack. Since strip stock from which laminations are punched is generally about 0.020 thick, a single lamination variation can produce a considerable difference in pole piece length . . . more than can be tolerated and approximately twice the variation that is easily held on the molded pole piece. In the case of length change for different motors, the required change is 1½" total or ¾" per molded pole piece. No changes in tools and no additional tools are needed to accomplish this change. By simply changing the depth of fill of the compacting dies, the shift is made. The projection and the indent on the flat end of the molded parts are both formed by the upper punch which remains constant. Overall length tolerances are still held as precisely on the part as before.

The mounting of the pole pieces in the motor frame has not been mentioned. For either type of part, the mounting method is the same. Not shown in the illustration is a tapped, blind hole on the back of each half pole. After the coil has been put into place, the assembly is bolted to the frame. While no figures are available, it is possible that the cost of drilling and tapping the hole is less in a powdered iron part than in a laminated part.

The result of the change from a laminated structure to a molded one has been a better part at lower costs, fewer rejected parts, fewer damaged field coils, lessened load on both manufacturing and tool room facilities and at least one assembly operation completely eliminated.

FORM UNION CARBIDE RESEARCH INSTITUTE

The formation of the Union Carbide Research Institute to engage in basic scientific research has been announced. It will be located near Tarrytown, N. Y. and will be completed early in 1958.

The Institute will be under the administration of Dr. Augustus Kinzel, vice-president—research of Union Carbide. Dr. E. R. Jette, formerly head of the Chemistry and Metallurgy Division at Los Alamos Scientific Laboratory, New Mexico, has been appointed the director of the Institute.

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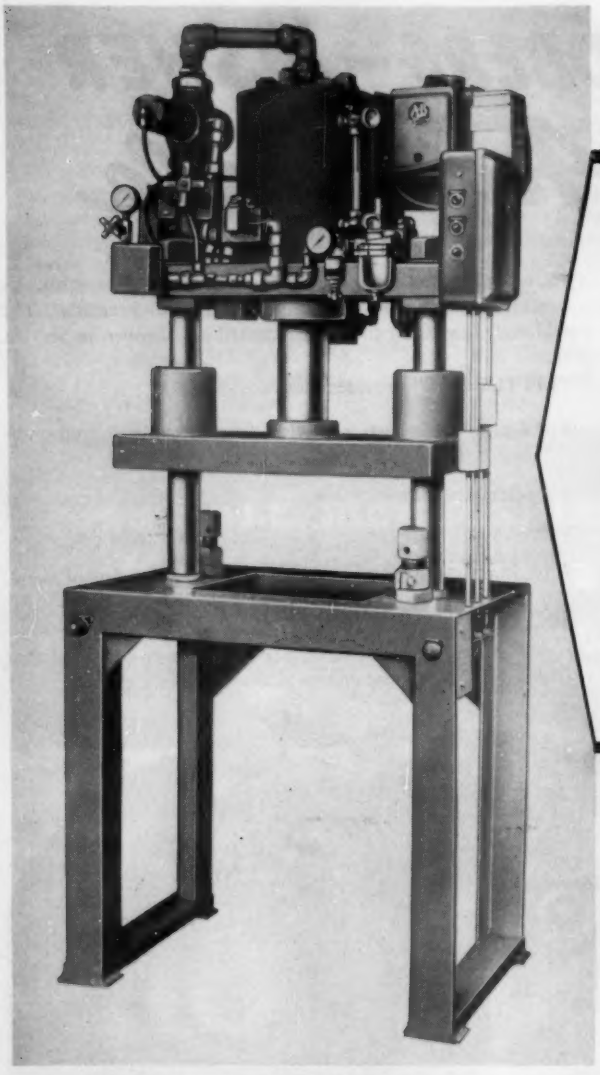

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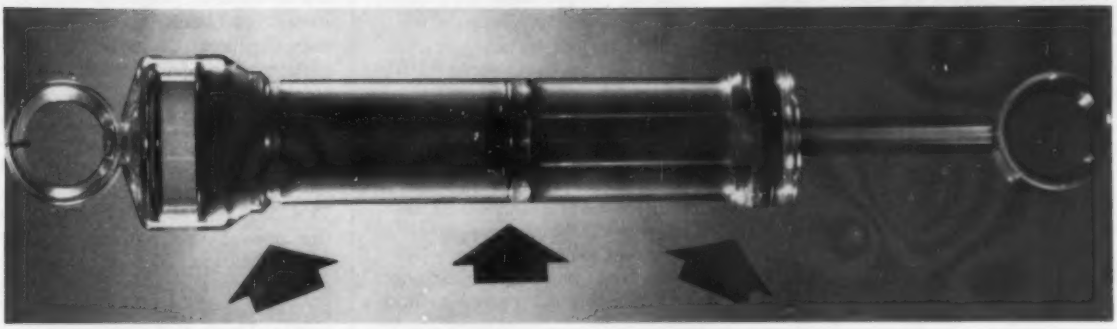
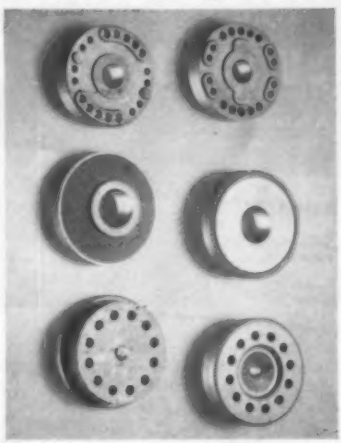


REALISTIC SPECIFICATIONS led designers to decide that the three powdered iron parts (below right) would do the job in this shock absorber, shown above in phantom view. Parts (l to r) cavitation plate, piston and guide bushing.

TABLE 1. How properties of powdered metal parts meet specifications.

Material: Powdered metal Fe 901 IPM Grade or equivalent.	
Ultimate tensile strength (psi min.)	40,000
Deformation in compression (.001, psi min.)	30,000
Porosity (percent by volume)	25
Density, without impregnation (grams/cc)	6.0 to 7.0
Coef. of thermal expansion (in./in./deg. F)	7.0×10^{-6}
PV Factor	25,000
Electrical resistance (microhm cm.)	25
Melting point (deg. F. min.)	2,000
Hardness (min. Brinell)	80
Composition . . . Iron, percent	90 to 93
Copper, percent	7 to 10

(Note: Hardness for the guide bushing and cavitation plate as noted above for the piston, the Brinell hardness of the center boss is specified as 85 min.)



Why Pay Extra For Properties You Don't Need?

A major deterent to wider application of powdered metal parts has been the designer's insistence on utilizing materials having physical and mechanical properties far higher than needed.

Because a part has always been made from wrought bar stock, for example, does not mean that the wrought physical properties are necessary or always desirable. In many cases, manufacturing costs can be drastically cut by converting to a material of lesser, but completely adequate, strength but which can be fabricated by high speed, low cost methods. Parts made from metal powders very often fall in this category.

Two things the design engineer must know:

The *real* requirements as far as strength, wear resistance, corrosion resistance, finishability, etc. are concerned.

These same general properties of different materials fabricated by such methods as powder metallurgy, die casting, permanent mold casting, or other high speed, low cost production methods.

With this knowledge, machine components can be obtained at the lowest possible cost and will perform adequately under the service conditions for which they are designed.

The three shock absorber parts shown, above right, illustrate how a realistic appraisal allows wider latitude in manufacturing methods. All three of these parts are made from iron powder.

Assuming that a ferrous metal is the most desirable material, a number of different methods of

Continued next page

manufacture can be used. Parts could be machined from round bar stock, they could be machined sand castings, they could be machined forgings, or they might be pressed from powdered iron.

Before selecting the method of manufacture, the operational requirements had to be set up so that the choice could be made intelligently. A study of the parts disclosed that these minimal physical properties:

Ultimate tensile strength (psi)	40,000
Yield in compression (psi)	30,000
Weight lbs. per cu. in. (min.)	0.210
Coef. of thermal expansion (in./in./deg. F X 10^{-6}	7.0
Electrical resistance (microhm cm.)	25
Melting point (deg. F min.)	2,000
Hardness (Brinnell min.)	80

With these basic specifications, it was possible to study various methods of fabrication to determine which one would give the required properties at the lowest unit cost, always assuming the same degree of completion of the part, usually at assembly level.

WROUGHT BAR. As far as physical properties are concerned, either a 1010 or a 1020 steel would easily meet them. The problem in connection with the use of this material is one of fabrication. The dimensional requirements can be illustrated by taking the piston as an example. These tolerances are:

Outside diameter	±0.001
Bore diameter	±0.0005
Hole diameter	+0.000 −0.004
Angular, between holes	±1°
Flatness of bosses (referred to center boss)	±0.0005
Groove depth	±0.004 to 0.006 total depth.

To meet these dimensional controls, extremely precise machining would be necessary. Turning, milling, boring and reaming operations would be required and a large number of expensive jigs and fixtures would be needed.

Tooling costs would be excessive, rejection rates high, and an inventory of both bar stock and finished parts would have to be kept, inspection costs would be excessive and, unless large numbers of machine tools were installed, production rates would be slow.

When all factors are considered, the cost of producing parts by machining from bar stock would be so high that the finished shock absorber, into which these parts go, could not compete in today's market. This method, therefore, must be rejected.

SAND CASTINGS. Commercial grey or white cast iron would not have the physical properties required for this part. One of the special irons or a low alloy iron would have to be used. This would raise the cost of the castings above the cost of an equivalent piece of bar stock. In addition, all of the machine work that must be done when the part is cut from bar stock must still be done. A sand casting, therefore, could not be economically used.

FORGING. The advantage of a forging is the improved physical properties secured by hot working. In the case of these parts,

Here's What the Sales Dept. Suggested for This Month's Ad—

Actual copy of memo in our files:

ADVANCE PRESSURE CASTINGS, INC. — DATE December 10, 1956

INTER-DEPARTMENTAL MEMO • VERBAL ORDERS DO NOT GO

FROM: Sales Department — TO: Advertising Department

ATTENTION OF: — SUBJECT: COPY FOR JANUARY AD

I have your note asking what unusual production job should be featured in our January ad. There are several we could use, but for this month why not just stress these facts?

1. We are equipped with machines of greater flexibility and process than most other equally reputable suppliers.
2. Our seasoned, skilled organization takes a personal interest in every phase of an order
3. It's a matter of pride with us that we can furnish at an economical price castings which meet the highest specifications.

It seems to me these are all important points that should be emphasized in our advertising.

A. S.

ADVANCE PRESSURE CASTINGS, INC.
20-30 WYTHE AVENUE • BROOKLYN 11, NEW YORK

For more information circle No. 3 on the Reader Service Card

this improvement would not be an advantage. All of the machine work would still be required and there would be the added cost of forging dies. Forgings must therefore be rejected.

POWDERED METAL. By using a mixture of iron and copper powders with small amounts of carbon, a powder compact can be made which will meet all of the physical and mechanical requirements. With carefully made compacting tools and by coining after sintering, all of the dimensional requirements except flatness can be met. By making these parts of the proper metal powder mixture, therefore, the only machine work that must be done after they are received from the vendor is to hone the surfaces of the cavitation plate; the other two parts need no machine work.

The saving that results from the use of powder metallurgical methods for making these parts becomes immediately obvious. Tooling costs are materially reduced; no extensive machine shop facilities are required; inventory problems are cut to the simple stocking of finished parts; inspection is reduced to statistical minimums; and production rates can be geared to match the production of other shock absorber components so that no bottleneck in assembly will result from lack of these parts.

Currently these parts are being made for the Heckethorn Mfg. & Supply Co. by both U. S. Graphite Co. and the Rocky Mountain Div. of International Powder Metallurgy. Both companies manufacture to the same dimensional, physical, chemical and mechanical specifications. As finally evolved, the complete specifications for the material from which these parts are made are listed in Table 1.

Other specifications set up for these powdered iron parts are: Heco Inspection: Shipment shall be sampled and tested according to the requirements of Federal Specification MIL-STD-105A single sampling plan, inspection level II, the applicable A.Q.I. and critical quality-factors are available upon request. The acceptance of any lot by this sampling plan does not in any way waive the right of HECO to return for credit, any material that is later revealed defective and/or out of specification.

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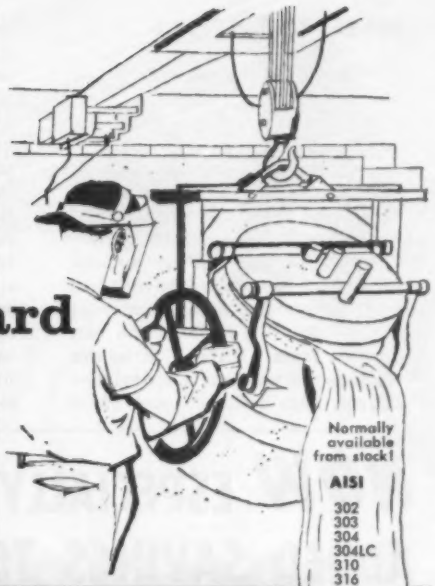

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303
304
304LC
310
316
330
347
410
416
420
431
440A
440C
440F

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INVAR
M-252
WASPALLOY
X-40

AMS
5334
5350
5354
5358
5360
5362
5366
5370
5373
5376
5382
5385
5610
5628
5630
5631
5640

SAE
"II" B-2
"II" D-2
M-2
T-1
1010
4130
4145
4620
52100
6150
8620

PWA651
PWA787M
*NI-RESIST 1A
*INCONEL
*MONEL
4750
WAD 8338
WAD 8370

Cannon-Muskegon can provide the alloy you need in whatever amount you want . . . with exactly predictable control of characteristics. Check the alloys we produce for industry's special needs . . . one or several can solve your problem. If not, Cannon-Muskegon can help you select and produce the right material . . . recommend proper handling methods for best results. You can be sure of getting the desired physical, chemical and electrical properties for your particular machining or processing operation. And remember — Cannon-Muskegon *certifies* specifications of its MasterMet alloys.

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CANNON-MUSKEGON CORPORATION
2871 Lincoln Street Muskegon, Michigan

*®International Nickel Co.

METALLURGICAL SPECIALISTS

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HALF THE STORY

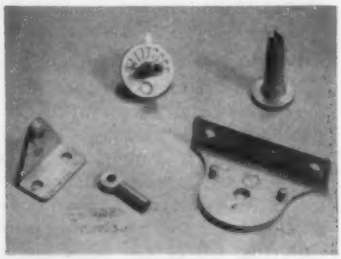
continued from page 58

in other cases, only tapping of the blind hole in the base and drilling of the cotter pin hole are needed to finish the part.

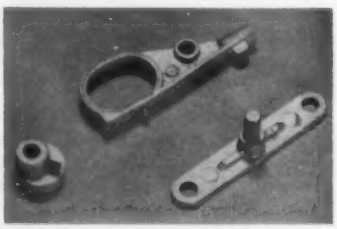
As in the case of the manual ventilator, the automatic unit has been designed to make maximum use of zinc die castings. As can be seen from Figure 1, three die castings are used on this device—a cam, cam follower and pivot plate. As before, the design is such that only the simplest machining operations are required to finish the castings.

The three castings are shown in greater detail in Figure 3. The pivot plate requires only drilling of the hole for the cotter pin to finish it. The cam follower needs two set screw holes drilled and tapped. The locating pin for the spring which actuates the microswitches, is cast on and the accuracy of the cam follower opening, as-cast and trimmed, is sufficiently good so that no finish machining is required.

The cam also requires drilling and tapping for the set screw and, in addition, must have the bore reamed to give the desired fit on the motor drive shaft. As



2. SIMPLE DRILLING and tapping are the only operations needed on these die castings for a manual ventilator.



3. NO FINISH MACHINING is needed before assembling these three zinc die castings in the automatic units.

in the case of the follower, the as-cast shape and dimensional accuracy of the cam is perfectly adequate for the use. It should be noted that, in all cases, standard die casting foundry tolerances are allowed.

With both the cam and cam follower of zinc, wear and galling would seem to present a problem. In this case, however, the speed of rotation, only 10 rpm, and the relatively light load allow the use of zinc on zinc.

None of the die cast parts reviewed receive any surface finish. And, in spite of world wide distribution of the incubators where the die castings are subjected to all sorts of atmospheric conditions, there has never been a service failure due to corrosion.

The reasons cited above are only a few of those that must be considered when a decision is made on a method of manufacture. Today, many, if not most, jobbing die casting shops are set up to do light machining in addition to normal trimming operations. Where this is the case, it is often possible to so design the parts that, as delivered by the vendor, they are finished and ready for assembly.

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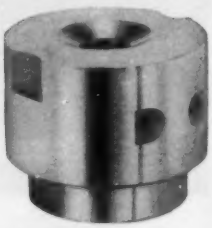

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- *Priced at $16.00 Each*

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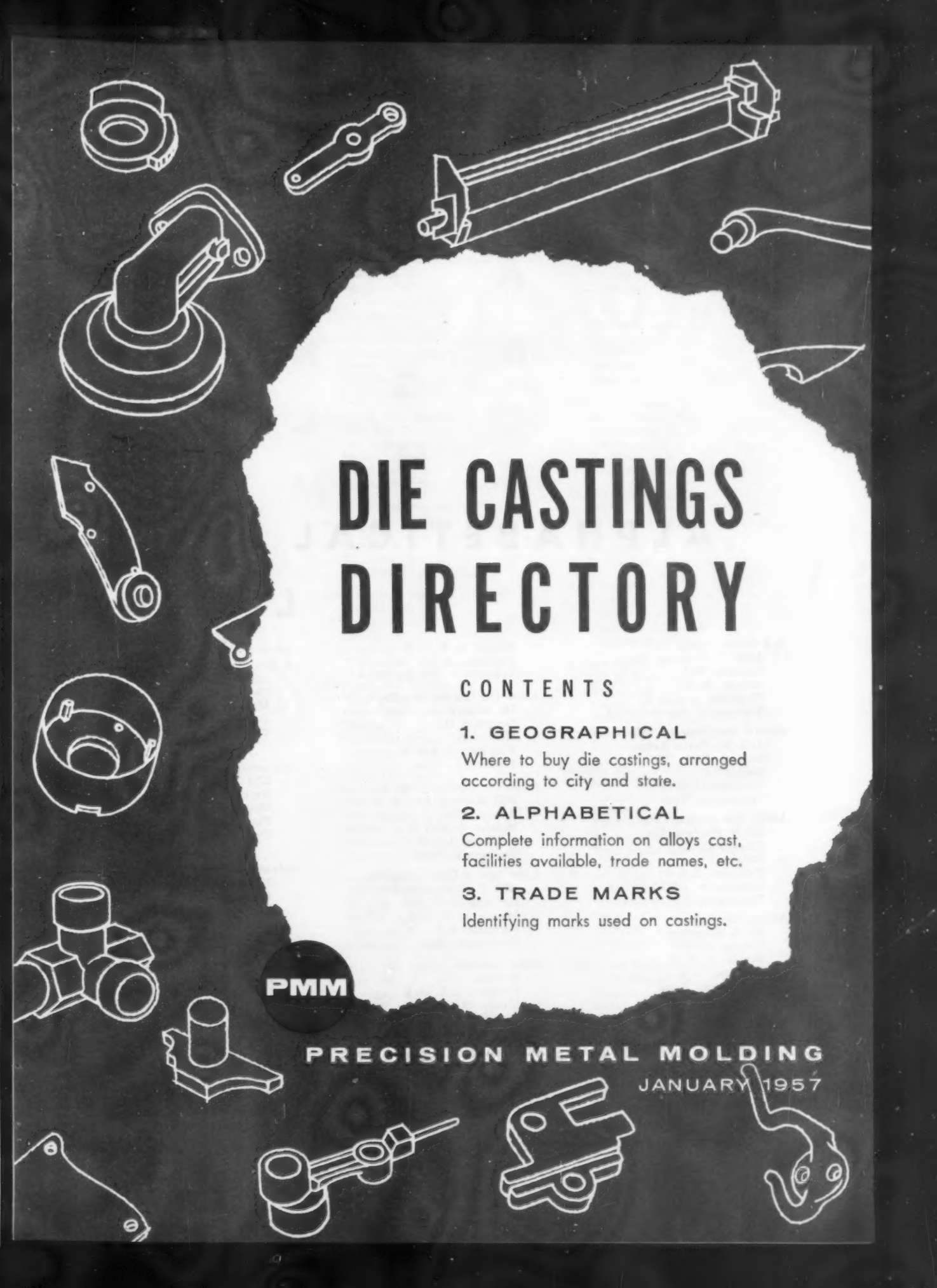

DIE CASTINGS DIRECTORY

CONTENTS

1. GEOGRAPHICAL
Where to buy die castings, arranged according to city and state.

2. ALPHABETICAL
Complete information on alloys cast, facilities available, trade names, etc.

3. TRADE MARKS
Identifying marks used on castings.

PMM

PRECISION METAL MOLDING

JANUARY 1957

ALPHABETICAL LISTING

A & A Die Casting Co.* **
12901 S. Western Ave.
Gardena, Cal.
Metals: A, D
Facilities: 1, 2, 3, 5
Trademark: See Section 3

Aallied Die Casting & Mfg. Co., Inc.
3108 W. North Ave.
Melrose Park, Ill.
Metals: A
Facilities: 1, 2, 5
Trademark: None

ABCO Die Casting Corp.
330 N. Harding Ave.
Chicago 24, Ill.
Metals: D
Facilities: 1, 2, 5
Tradename: ABCO
Trademark: See Section 3

Ability Die Casting* **
865 N. Sangamon
Chicago 22, Ill.
Metals: A, D, E
Facilities: 1, 2, 5
Trademark: None

Accessories Mfg. Co.
5075 14th St.
Detroit 8, Mich.
Metals: D
Facilities: 1, 3, 5, 6
Trademark: None

Accurate Die Casting Co., The* **
3089 E. 80
Cleveland 4, O.
Metals: A, B, C, D
Facilities: 2, 5
Trademark: See Section 3

Acme Die Casting Co., Inc.
746 Albany
Dayton 8, O.
Metals: A
Facilities: 1, 3, 4, 5
Trademark: None

Acme Die Casting Corp.
1635 Murrary Ave.
Racine, Wis.
Metals: A, D
Facilities: 1, 2, 5
Trademark: None

Acme Tool & Die Casting Co.
4250 E. Washington Blvd.
Los Angeles 23, Cal.
Metals: A, C, D, E
Facilities: 2, 5
Trademark: None

Adept Castings, Inc.
39 Hanse Ave.
Freeport, L. I., N. Y.
Metals: D
Facilities: 1, 2, 5
Trademark: None

Adjel Products Co.
13561 Helen Ave.
Detroit 12, Mich.
Metals: D
Facilities: 1, 3, 5, 6
Trademark: None

Admiral Die Castings
A Div. Portable Electric Tools, Inc.
250 W. 83
Chicago 20, Ill.
Metals: A, D
Facilities: 1, 2, 3, 5
Trademark: See Section 3

Advanced Manufacturing, Inc.
1214 W. 254
Harbor City, Cal.
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: None

Advance Pressure Castings, Inc.* **
20-30 Wythe Ave.
Brooklyn 11, N. Y.
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3
Representatives: *Detroit, Mich.*, J. J. Jordan, 15324 Mack Ave., *Philadelphia, Pa.*, Robert Baron, Presidential Apts. A-710.

Advance Tool & Die Casting Co.* **
3760 N. Holton
Milwaukee 12, Wis.
Metals: A, D
Facilities: 2, 5, 6
Trademark: See Section 3
Representatives: *Detroit, Mich.*, M-S Sales Co., 723 Fisher Bldg.

For interpretation of all symbols, see page 94.

Airtex Products, Inc.
Fairfield, Ill.
Metals: D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: See Section 3

Ajax Die Casting & Mfg. Co.
2002 E. 6
Tulsa, Okla.
Metals: A, D
Facilities: 1, 2, 5
Trademark: None

Akron Presform Mold Co., The
2038 Main
Cuyahoga Falls, O.
Metals: A
Facilities: 1, 2, 4, 5, 6
Trademark: None

Alabama Wire Co., Inc.
Sycamore & Terrace Sts.
Florence, Ala.
Metals: A
Facilities: 2, 4, 5
Tradename: Dimension Die Castings
Trademark: None

Albany Plating & Die Casting Co.
464 W. 33
Chicago 16, Ill.
Metals: D
Facilities: 1, 3, 5, 6
Tradename: Albanizing
Trademark: None

Allen-Stevens Corp.* **
33-53 62nd Street
Woodside 77, N. Y.
Metals: D
Facilities: 1, 2, 4, 5
Trademark: See Section 3

Alloy Die Casting Co.*
2211 Firestone Blvd.
Los Angeles 2, Cal.
Metals: A, B, D
Facilities: 1, 2, 5
Trademark: See Section 3

Alpha Industries
Die Casting Div.
1300 Wheatland Ave.
Logansport, Ind.
Metals: A
Facilities: 1, 2, 4, 5
Trademark: See Section 3

Alumiloy Fabricators, Inc.
202 W. Bennett, P. O. Box 624
Saline, Mich.
Metals: A
Facilities: 1
Trademark: See Section 3

Aluminum Company of America*
Madison & Mannheim Rd.
Bellwood, Ill.
Metals: A, C
Facilities: 1, 2, 5
Tradename: ALCOA
Trademark: See Section 3

Aluminum Company of America*
Garwood, N. J.
Metals: A, C
Facilities: 1, 2, 5
Tradename: ALCOA
Trademark: See Section 3

Aluminum Co. of Canada Ltd.
Castings Div.
15 Brown's Line
Toronto 14, Ont., Canada
Metals: A, C
Facilities: 4
Tradename: ALCAN
Trademark: None

Aluminum Die Cast Foundries, Inc.
Winchester, Ind.
Metals: A
Facilities: 1, 2, 4, 5, 6
Trademark: None

Aluminum Die Casting Co.*
3452 San Fernando Rd.
Los Angeles 65, Cal.
Metals: A
Facilities: 1, 2, 5, 6
Trademark: See Section 3

Ambrit Industries, Inc.* **
1288 Los Angeles
Glendale 4, Cal.
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

American Aluminum Casting Co.
332-334 Coit
Irvington, N. J.
Metals: A
Facilities: 2, 4
Trademark: See Section 3

American Die Casting Co.
850 Pannell St., N.W.
Grand Rapids 4, Mich.
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Anderson Die Casting & Engineering Co.* **
1000 E. 60
Los Angeles 1, Cal.
Metals: A, B, C, D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Anderson Tool & Mfg. Co.
3450 N. Kostner Ave.
Chicago 41, Ill.
Metals: A, D
Facilities: 2, 5
Trademark: None

Arkansas Die Casting Co.
Box 748
Harrison, Ark.
Metals: A, D
Facilities: 1, 2, 5, 6
Trademark: None

Arrow-Acme Corp.
411 Prospect
Webster City, Ia.
Metals: A, D
Facilities: 1, 5
Trademark: None

Arrow Aluminum Castings Co.
3135 Berea Rd.
Cleveland 11, O.
Metals: A, D
Facilities: 2, 4, 5
Trademark: None

Atlantic Die Casting Co.
17740 Clarann
Melvindale, Mich.
Metals: A
Facilities: 2
Trademark: See Section 3

Atlas Auto Products, Inc.
5815 Wilmington Ave.
Los Angeles 1, Cal.
Metals: D
Facilities: 1, 3, 6
Trademark: None

Atlas Die Casting Co.*
362 N. Kelley Ave.
Germantown, O.
Metals: A, D
Facilities: 2, 5
Trademark: See Section 3

Atomic Die Casting Corp.
7817 S. Claremont Ave.
Chicago 20, Ill.
Metals: A, D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: See Section 3

Auel Industries
Herminie, Pa.
Metals: D
Facilities: 1, 2, 5, 6
Trademark: None

Aurora Metal Co.
614 W. Park Ave.
Aurora, Ill.
Metals: B
Facilities: 2, 5
Tradename: Aur-O-Met
Trademark: See Section 3

Badger Die Casting Corp.* **
201 W. Oklahoma Ave.
Milwaukee 7, Wis.
Metals: A, D
Facilities: 1, 2, 5
Tradename: Badger
Trademark: See Section 3

Banner Metal Products Ltd.
1680 Kildare Rd.
Windsor, Ont., Canada
Metals: D
Facilities: 1
Trademark: None

Banthrico Industries, Inc.
17 N. Desplaines
Chicago 6, Ill.
Metals: D, E
Facilities: 1, 2, 6
Trademark: None

Barber Die Casting Co. Ltd.
Postal Station "B", Box 240
Hamilton, Ont., Canada
Metals: A, B, C, D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: See Section 3

For interpretation of all symbols, see page 94.

Barrington Tool & Engineering Co.
335 E. Station
Barrington, Ill.
Metals: D
Facilities: 1, 2, 5, 6
Trademark: None

Basic Aluminum Casting Co.
1325 E. 168
Cleveland 10, O.
Metals: A
Facilities: 1, 2, 5
Trademark: See Section 3

Beaut Mfg. Co., Inc.
7500 Tonnelle Ave.
North Bergen, N. J.
Metals: B, D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: None

Benda Tool & Model Works
1444 Fourth St.
Berkeley 7, Cal.
Metals: A, D
Facilities: 1, 2, 5
Trademark: None

Bendix Foundries
Teterboro, N. J.
Metals: A, C
Facilities: 2, 4
Tradename: Bendix
Trademark: See Section 3
Representatives: *Manchester, Conn.*, John Treybal; *Teterboro, N. J.*, Lawrence Eigenrauch, Frank Goodman, Edward J. Schultz; *Chester, Pa.*, George Foster, Jr. (no street addresses given).

Benton Harbor Malleable Industries, Inc.
171 Graham Ave.
Benton Harbor, Mich.
Metals: D
Facilities: 5
Trademark: See Section 3

Blaking Co.
921 N. E. Main
Minneapolis, Minn.
Metals: D
Facilities: 1, 2, 4, 5, 6
Trademark: None

Blue Ridge Pressure Castings, Inc.*
Bridge St.
Lehighton, Pa.
Metals: A, B, D
Facilities: 2, 5
Trademark: See Section 3

Chas. D. Briddell, Inc.
Crisfield, Md.
Metals: D
Facilities: 1, 3, 4, 5, 6
Trademark: None

Brillcast, Inc.
2544 Thornwood, S.W.
Grand Rapids 9, Mich.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Tradename: Brillcast
Trademark: See Section 3

Bruce Mfg. & Molding Co., Inc.
Atwater St.
Plantsville, Conn.
Metals: A, D
Facilities: 1, 2, 4, 5, 6
Trademark: None

Bruin Mfg. Co.
607 N. Fourth Ave.
Marshalltown, Ia.
Metals: A, D
Facilities: 1, 2, 5, 6
Trademark: See Section 3

Bucy Mfg. Co.
625 S. Glenwood Pl.
Burbank, Cal.
Metals: A, D
Facilities: 2
Trademark: None

Buehrle Engineering Co.
856 E. Broadway
Muskegon, Mich.
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

Caldwell Casting Co., Inc., The
Falls & Shoemaker Rds.
Baltimore 9, Md.
Metals: D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: None

Callen Mfg. Corp.* **
1425 N. First Ave.
Maywood, Ill.
Metals: D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: None

Camp Aircraft Parts, Inc.
1133-39 McCarter Hwy.
Newark 2, N. J.
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

Cannon Electric Co.
3209 Humbolt
Los Angeles 31, Cal.
Metals: A, B, D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: None

Carpenter Die Casting Co. Ltd.
474 Burlington St., E.
Hamilton, Ont., Canada
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

J. I. Case Co.
Magneto Div.
S. Independence Ave.
Rockford, Ill.
Metals: A
Facilities: 1, 5
Trademark: See Section 3

Casper's Machine Shop
1047 77th Ave.
Oakland, Cal.
Metals: D
Facilities: 1, 2, 5
Trademark: None

Central Casting Co.
400-416 Trumbull
Elizabeth, N. J.
Metals: A, D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: None

Central Die Casting & Mfg. Co., Inc.* **
2935 W. 47
Chicago 32, Ill.
Metals: A, D
Facilities: 1, 2, 4, 5
Trademark: See Section 3

Century Die Casting Co.*
2629 W. Fletcher
Chicago 18, Ill.
Metals: A, D
Facilities: 2
Trademark: See Section 3

Challenger Lock Co., Inc.
4865 Exposition Blvd.
Los Angeles 16, Cal.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Tradename: Challenger
Trademark: See Section 3

W. L. Chapman Co.
2886 E. Walnut
Pasadena 8, Cal.
Metals: A, B
Facilities: 2
Trademark: None

Char-Lynn Co.*
2843 26th Avenue, S.
Minneapolis 6, Minn.
Metals: A
Facilities: 2, 5
Trademark: None

Chautauqua Hardware Corp.
31 Water
Jamestown, N. Y.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Chicago Die Casting Mfg. Co.
2510 W. Monroe
Chicago 12, Ill.
Metals: D
Facilities: 1, 2, 5, 6
Trademark: None

Chicago Expansion Bolt Co.
1338 W. Concord Pl.
Chicago 22, Ill.
Metals: E
Facilities:
Trademark: None

Chicago White Metal Casting, Inc.* **
5239 W. Grand Ave.
Chicago 39, Ill.
Metals: A, D
Facilities: 2
Trademark: None

For interpretation of all symbols, see page 94.

Representatives: *Chicago, Ill.*, F. B. Kruchten, 9633 S. Dobson, Nate Levinson, 2944 W. Chase Ave.; *Michigan City, Ind.*, Syd Gregory, 2909 Lakeshore Dr., Longbeach; *New York, N. Y.*, E. O. & L. L. McDowell, 175 Fifth Ave.; *Shaker Heights, O.*, A. L. Gordon, 2525 Kemper Rd.; *Philadelphia, Pa.*, W. Hubbert, 101 N. 33; *Milwaukee, Wis.*, Mielke & Bemm, Inc., 1409 N. 27.

Cincinnati Die Casting Co., The*
2117 Spring Grove Ave.
Cincinnati 14, O.
Metals: A, D
Facilities: 1, 2, 5
Tradename: CINDIE
Trademark: See Section 3

Cleveland Hardware & Forging Co., The* **
Die Cast Division
4518 Lakeside Ave.
Cleveland, O.
Metals: A, D
Facilities: 2, 5
Trademark: See Section 3
Representatives: *Plainville, Conn.*, Edwin S. Hanny, 166 Trumbull Ave.; *Chicago, Ill.*, Lou Lundstedt, 4554 Broadway; *Richmond, Ind.*, Earl Oswalt, 2821 E. Main; *Ann Arbor, Mich.*, Vince Vande Motter, 725 Sunset Rd.; *St. Louis, Mo.*, J. Grant, 1246 Hampton Ave.; *Buffalo, N. Y.*, Harry Harding, 235 Burke Dr.; *New York, N. Y.*, John J. Murray, 50 Church; *Cleveland, O.*, Ken Nungesser, 3270 E. 79, Casey Stanison, 3270 E. 79; *Pittsburgh, Pa.*, A. W. Anderson, 425 Grand Bldg.; *Wynnewood, Pa.*, Harold T. Sorensen, 425 Charles Lane; *Milwaukee, Wis.*, R. P. Vallee, 2302 W. Clybourn.

Clyde Equipment Co.
3816 McDonald
St. Louis 16, Mo.
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Colbert Die Cast Co.
5416 Tweedy Blvd.
South Gate, Cal.
Metals: A, D
Facilities: 1, 2, 5, 6
Trademark: None

Comet Metal Products Co., Inc.
91-00 132 Street
Richmond Hill 18, N. Y.
Metals: D, E
Facilities: 1, 2, 6
Trademark: None

Conetta Tool & Die Co., Inc.
73 Sunnyside Ave.
Stamford, Conn.
Metals: D
Facilities: 1, 2, 5
Trademark: None

Congdon Die Casting Co.
1266 Godfrey Ave., S.W.
Grand Rapids, Mich.
Metals: D
Facilities: 5
Trademark: None

Conneaut Die Casting* **
618 Sandusky
Conneaut, O.
Metals: A, D
Facilities: 1, 2, 5, 6
Trademark: None

Consolidated Die Cast Corporation of America
Dowagiac, Mich.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Continental Die Casting Corp.* **
9615 Grinnell Ave.
Detroit 13, Mich.
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Continental Metallifacture Co.
414 Pine
Scranton, Pa.
Metals: A, D
Facilities: 1, 5
Trademark: None

Robert A. Cox Die Casting Co.*
11418 Knightsbridge Ave.
Culver City, Cal.
Metals: A
Facilities: None
Trademark: See Section 3

Criterion Toy & Specialty Co., Inc.
22-14 40th Ave.
Long Island City 1, N. Y.
Metals: D
Facilities: 1, 6
Trademark: None

Dallas Die-Casting Co.
316 Rock Island
Dallas 7, Tex.
Metals: A, B, D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: See Section 3

Danacor Co.
430 Carroll
Brooklyn 15, N. Y.
Metals: D
Facilities: 1, 2, 5
Trademark: None

Edward W. Daniel Co.
4050 St. Clair Ave.
Cleveland 3, O.
Metals: D
Facilities: 1, 5, 6
Trademark: See Section 3

Darmon Tool & Mfg. Corp.
2664 Park Ave.
New York, N. Y.
Metals: D
Facilities: 1, 2, 5, 6
Trademark: None

Dayton Die Casting Co.
111 Front
Dayton 2, O.
Metals: A, D, E
Facilities: 1
Trademark: None

Dearborn Diecasting & Cavity Co.
199 Vinewood Ave.
Detroit 16, Mich.
Metals: D
Facilities: 1, 2, 5
Trademark: None

DeCardy Bros. Co.*
1806 N. Keeler Ave.
Chicago 39, Ill.
Metals: D, E
Facilities: 2, 5
Trademark: None

DeLaval Separator Co.
25 Columbia
Poughkeepsie, N. Y.
Metals: D
Facilities: 1, 4, 5, 6
Trademark: See Section 3

Delta Die Casting Corp.*
9393 W. Seymour Ave.
Schiller Park, Ill.
Metals: A
Facilities: 1, 2, 4
Trademark: See Section 3

Denham Mfg. Co.
Pere Marquette St.
Big Rapids, Mich.
Metals: D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: See Section 3

DeRoy Mfg. Co.
9208 Atlantic Ave.
South Gate, Cal.
Metals: D
Facilities: 1, 2, 5
Trademark: None

Detroit Die Casting Corp.* **
597 Beaufait Ave.
Detroit 7, Mich.
Metals: D
Facilities: 3
Trademark: See Section 3

Detroit Ice Machine Co.
2615 12th St.
Detroit 16, Mich.
Metals: A
Facilities: 5
Tradename: DIMCO
Trademark: None

Dialoy, Inc.
214 S. Clinton
Chicago 6, Ill.
Metals: A, D
Facilities: 2, 4, 5
Tradename: DIALOY
Trademark: None

Diecasters, Inc.
Ridgefield, N. J.
Metals: A, D
Facilities: 1, 2, 5, 6
Trademark: See Section 3

For interpretation of all symbols, see page 94.

Die Cast Products, Inc.* **
621 W. Rosecrans Ave.
Gardena, Cal.
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

Die Cast Products, Inc.
4040 Hough Ave.
Cleveland 3, O.
Metals: A, D, E
Facilities: 1, 5
Trademark: None

Die Casting Corp. of Florida
3000 N. W. 75
Miami 47, Fla.
Metals: A, D
Facilities: 2
Trademark: None

Dieco Die Casting Corp.
59-27 Decatur
Brooklyn 27, N. Y.
Metals: D
Facilities: 1, 2, 5
Trademark: See Section 3

J. E. Dietz Mfg. Co.
9216 Bermudez
Rivera, Cal.
Metals: D
Facilities: 1, 2, 5
Trademark: None

Dixie Die Casting Corp.
Box 1208
Reidsville, N. C.
Metals: A
Facilities: 2, 4, 5
Trademark: See Section 3

Dollin Corp.* **
600 S. 21
Irvington 11, N. J.
Metals: A, D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: See Section 3
Representatives: *Chicago, Ill.*, Hember & Assoc., 1554 Howard; *Louisville, Ky.*, Marvin C. Greer, P. O. Box 181; *Boston, Mass.*, B. F. Jaques, 67 Batterymarch; *Detroit, Mich.*, Fralick Co., The, 18040 James Couzens Hwy.; *St. Paul, Minn.*, A. A. Gustafson, 2580 University Ave.; *St. Louis, Mo.*, E. T. Bergmann, 3910 Lindell Blvd.; *Buffalo, N. Y.* Robert Kleindinst, P. O. Box 18; *Charlotte, N. C.*, G. S. Patton, 1835 Harris Rd.; *Canton, O.*, A. H. Dervin, 217 18th St., N.W.; *Hershey, Pa.*, Edward A. Linhart, P. O. Box 366.

Dominion Die Casting Ltd.
Heinz St.
Wallaceburg, Ont., Canada
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

Douglas Co., The
620 12th Ave., S.
Minneapolis, Minn.
Metals: D
Facilities: 2, 3, 5, 6
Tradename: Chrome Craft
Trademark: None

Dow Chemical Co., The*
Magnesium Die Casting Sales
Midland, Mich.
Metals: A, C
Facilities: 2, 5
Trademark: See Section 3

Duane Specialties, Ltd.
209 Parkhurst
Newark 5, N. J.
Metals: D
Facilities: 1, 2, 5
Trademark: See Section 3

DuPage Die Casting & Fabricating Co., Inc.
8049 N. Ridgeway Ave.
Skokie, Ill.
Metals: A, D
Facilities: 2, 5
Trademark: See Section 3

DuWel Metal Products, Inc. * **
P. O. Box 307
Bangor, Mich.
Metals: A, D
Facilities: 1, 2, 5
Tradename: DU-WEL
Trademark: See Section 3

Dynamic Die Casting Co.
510 W. Ten Mile Rd.
Madison Heights, Mich.
Metals: D
Facilities: None
Trademark: None

E. B. Metal Products Co., Inc.
12-12 Bridge Plaza, S.
Long Island City 1, N. Y.
Metals: D
Facilities: 2, 5, 6
Trademark: None

Eastern Electric, Inc.
70 Prospect
New Bedford, Mass.
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: None

Eastern Malleable Iron Co.
Eastern Casting Corp. Div.
Newburgh, N. Y.
Metals: A
Facilities: 1, 2, 4, 5
Trademark: See Section 3
Representatives: *Naugatuck, Conn.*, Eastern Malleable Iron Co.; *Wilmington, Del.*, Eastern Malleable Iron Co.; *Union, N. J.* Talbot Associates, Inc., 1865 Morris Ave.; *New York, N. Y.*, Talbot Associates, Inc., 122 E. 42; *Syracuse, N. Y.*, Frazer & Jones Co.; *Cleveland, O.*, Eastern Malleable Iron Co., Eberhard Mfg. Div., 2734 Tenyson.

Eastern Metal Products Corp.
Box 852, Chaffee Access Rd.
Ft. Smith, Ark.
Metals: A, B, D
Facilities: 1, 2, 4, 5, 6
Tradename: EMPCO
Trademark: See Section 3

R. H. Eggers Co.
4701 Perkins Ave.
Cleveland 3, O.
Metals: A
Facilities: 1, 5, 6
Trademark: None

Ehrhart Die Casting Co.
K.O.K.X. Road
Hamilton, Ill.
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: None

Eklind Tool & Mfg. Co.
2627 N. Western Ave.
Chicago 47, Ill.
Metals: D
Facilities: 1, 2, 5
Trademark: None

El Cajon Die Casting & Mfg. Co.
590 Marshall Ave.
El Cajon, Cal.
Metals: D
Facilities: 1, 2, 4, 5
Trademark: None

Electric Auto-Lite Co., The
Lamp Div.
Cincinnati 15, O.
Metals: A, D
Facilities: 1, 2, 3, 4, 5
Tradename: Auto-Lite
Trademark: See Section 3

Electric Auto-Lite Co., The
Lockland Div.
Lockland P. O. Box 35
Cincinnati 15, O.
Metals: A, D
Facilities: 1, 2, 3, 4, 5, 6
Tradename: Auto-Lite
Trademark: See Section 3

Electric Auto-Lite Co., The
Woodstock Div.
1st & Clay Sts.
Woodstock, Ill.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Tradename: Auto-Lite
Trademark: See Section 3

El Monte Tool & Die Casting, Inc.*
10948 Schmidt Rd.
El Monte, Cal.
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

Empire Die Casting Co.
19600 Miles Ave.
Cleveland 28, O.
Metals: A, D
Facilities: 2, 5
Tradename: Empire
Trademark: See Section 3

Engineering Cast Products
17601 Swift
Detroit 3, Mich.
Metals: A, B, C, D
Facilities:
Tradename: Pressure Casting
Trademark: None

For interpretation of all symbols, see page 94.

Enhorning Industries
2013 W. 69
Chicago 36, Ill.
Metals: D
Facilities: 1, 2, 5
Trademark: None

Ertl Co., The
2475 Ertl Lane
Dubuque, Ia.
Metals: A, D
Facilities: 1, 5, 6
Trademark: None

Exact Tool & Die Co.
5829 Tireman Ave.
Detroit 4, Mich.
Metals: A
Facilities: 1, 2, 5
Trademark: See Section 3

Excel Products Co., Inc.
Codwise Ave. & Elizabeth St.
New Brunswick, N. J.
Metals: D
Facilities: 1, 2, 5, 6
Trademark: None

Falconer Metal Specialty Co., Inc.* **
Winchester Rd.
Lakewood, N. Y.
Metals: A, D
Facilities: 1, 2, 5, 6
Trademark: See Section 3

Faultless Caster Corp.
1421 N. Garvin
Evansville 7, Ind.
Metals: D
Facilities: 1, 2, 3, 4, 5, 6
Tradename: Faultless
Trademark: None

Federal Die Casting Co.* **
2220 Elston Ave.
Chicago 14, Ill.
Metals: A, D
Facilities: 1, 2, 4, 5, 6
Trademark: See Section 3

Finkel Umbrella Frame Co., Inc.
200 Brush Ave.
Bronx 65, N. Y.
Metals: D
Facilities: 1, 5, 6
Trademark: None

Fort Die Casting Corp.
Marysville, Mich.
Metals: A, D, E
Facilities: 1, 2, 3, 5
Trademark: See Section 3

Frantz Mfg. Co.
1200 Camden Ave., S.W.
Canton 6, O.
Metals: D
Facilities: 1, 2, 5, 6
Trademark: See Section 3

Future Products Co.
3625 N. Mississippi Ave.
Portland 12, Ore.
Metals: D
Facilities: 1, 3, 5
Trademark: See Section 3

Gasket, Packing & Specialty Co, Inc.
3-5 Waverly Pl.
New York 3, N. Y.
Metals: E
Facilities: 1, 2, 5, 6
Trademark: None

Gemco Mfg. Co.
501 S. Lipan
Denver 23, Colo.
Metals: A, D
Facilities: 1, 2, 5
Trademark: None

General Die Casting Co.
1956 Burdette
Ferndale 20, Mich.
Metals: D
Facilities: 3, 5, 6
Trademark: None

General Electroplating Co.
601 Russell Ave.
Indianapolis 25, Ind.
Metals: D
Facilities: 1, 3, 5, 6
Trademark: None

General Metals Corp.
444 S. Ninth Ave.
Mt. Vernon, N. Y.
Metals: D
Facilities: 1, 2, 3, 6
Trademark: None

General Motors Corp.
Fabricast Div.
P. O. Box 211
Malvern, Ark.
Metals: A
Facilities:
Tradename: FABRICAST
Trademark: See Section 3

General Motors Corp.
Fabricast Div.
P. O. Box 271
Bedford, Ind.
Metals: A
Facilities:
Tradename: FABRICAST
Trademark: See Section 3

Gordon Mfg. Co. Ltd.
1390 Wallace
Wallaceburg, Ont., Canada
Metals: A
Facilities: 2, 5
Tradename: PERMOLD
Trademark: None

Gorton & MacIntyre
70 Traverse Ave.
Port Chester, N. Y.
Metals: D
Facilities: 1, 5
Trademark: None

Grand Die Casting, Inc.*
7936 W. Grand Ave.
Elmwood Park 35, Ill.
Metals: A, D
Facilities: 2, 5
Trademark: None

Grand Rapids Brass Co.
Div. of Crampton Mfg. Co.
420 50th St., S.W.
Grand Rapids 8, Mich.
Metals: A, D
Facilities: 1, 3, 5, 6
Trademark: See Section 3

Grand Rapids Die Casting Co.
2125 Turner Rd., N. W.
Grand Rapids 4, Mich.
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Grand Steel & Mfg. Co.
1400 W. 14 Mile Rd.
Clawson, Mich.
Metals: A, D
Facilities: 1, 3, 5
Trademark: See Section 3

Great American Plastics Co.
Factory St.
Nashua, N. H.
Metals: D
Facilities: 1, 2, 5, 6
Tradename: Irwin
Trademark: See Section 3

C. M. Grey Mfg. Co. * **
358 Central Ave.
East Orange, N. J.
Metals: A, D, E, F
Facilities: 2, 5
Trademark: See Section 3

Gries Reproducer Corp.* **
140 Beechwood Ave.
New Rochelle, N. Y.
Metals: D
Facilities: 1, 2, 3, 4, 5
Trademark: See Section 3
Representatives: *Los Angeles, Cal.* Hargrove-Green Co., 5429 Alhambra Ave.; *Chicago, Ill.*, Jay C. Angel & Co., 2743 W. Peterson Ave.; *Westwood, Mass.*, G. W. Byron, 77 Greenhill Rd.; *Excelsior, Minn.*, A. R. Compton, P. O. Box 425; *Shaker Heights, O.*, H. F. Davis & Sons, 3262 Warrington Rd.; *Milwaukee, Wis.*, Clarence W. Binzel, 305 Century Bldg.

H & M Industries, Inc.
26810 Telegraph Rd.
Flat Rock, Mich.
Metals: A, C, D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: See Section 3

Hadlock & Temte, Inc.
P. O. Box 405
Winfield, Ill.
Metals: D
Facilities: 1, 2, 5
Trademark: See Section 3

Halex Die Casting Co.
8640 Bessemer Ave.
Cleveland 27, O.
Metals: A, D
Facilities: 1, 2, 5
Trademark: None

For interpretation of all symbols, see page 94.

C. M. Hall Lamp Co.
1035 E. Hancock Ave.
Detroit 7, Mich.
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: None

Hall-Wessel Co.
919-931 N. Fifth
Philadelphia 23, Pa.
Metals: D
Facilities: 1, 2, 5
Trademark: See Section 3

Hamilton Diecasting Corp.*
Nassau Terminal—Jericho Turnpike
New Hyde Park, L. I., N. Y.
Metals: A, D
Facilities: 1, 2, 5
Trademark: None

Hamlin Products, Inc.
7600 Asher Ave., P. O. Box 2016
Little Rock, Ark.
Metals: A
Facilities: 1, 2, 4, 5, 6
Trademark: None

Hampden Brass & Aluminum Co.
262 Liberty
Springfield 1, Mass.
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

Harbot Die Casting Corp.*
52 E. Centre
Nutley 10, N. J.
Metals: A
Facilities: 1, 2, 5
Trademark: None

Hardy Mfg. Corp.
Sub. of Sheller Mfg. Corp.
Union City, Ind.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Harvill Corp.* **
6251 W. Century Blvd.
Los Angeles 45, Cal.
Metals: A, B, C, D
Facilities: 1, 2, 5
Trademark: See Section 3

Haug Die Casting Corp.
52 Brown Ave.
Springfield, N. J.
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: None

Hayden Mfg. Co.
173 N. Peoria
Chicago, Ill.
Metals: D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: None

Heick Die Casting Corp.* **
6550 W. Diversey Ave.
Chicago 35, Ill.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Helfrich Die Casting Co.
208 Schneider Rd.
North Canton, O.
Metals: D
Facilities: 1, 2, 5
Trademark: See Section 3

Helm Accessories, Inc.
8820 Grinnell
Detroit 13, Mich.
Metals: D
Facilities: 1, 5
Trademark: None

Hermel Die Casting Corp.
P. O. Box 141
Eau Claire, Mich.
Metals: A, D
Facilities: 1, 2, 5
Trademark: None

Hilfinger Corp.* **
1800 Westwood Ave.
Toledo 7, O.
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Holland Die Casting Co., Inc.
582 Gordon
Holland, Mich.
Metals: D
Facilities: 5
Trademark: See Section 3

Hooper Die Casting
300 Maple Ave.
Trenton 8, N. J.
Metals: D
Facilities: 2
Trademark: None

Hoover Co., The* **
Die Casting Div.
North Canton, O.
Metals: A, D
Facilities: 2, 5
Tradename: Hoover
Trademark: See Section 3
Representatives: *Royal Oak, Mich.*, Earl M. Hovey, 4346 N. Woodward Ave. *(Detroit Area)*; *North Canton, O.*, C. R. Nelius, c/o The Hoover Co. *(Midwest)*; E. R. Speicher, c/o The Hoover Co. *(East)*.

Hoover Ball & Bearing Co.
Universal Die Casting Div.
232 Monroe
Saline, Mich.
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: None

Hudson Valley Aluminum Co., Inc.
Box 506
Newburg, N. Y.
Metals: A
Facilities: 1, 2, 5
Trademark: None

R. W. Hughes Industries, Inc.
2713 Ludelle
Ft. Worth, Tex.
Metals: A, D
Facilities: 1, 2, 4, 5
Trademark: None

Hyatt Die Casting Co.
428 Gratiot, Box 41
Ovid, Mich.
Metals: D
Facilities: 1, 2, 5, 6
Trademark: None

Ideal Toy Corp.
184-10 Jamaica Ave.
Hollis, N. Y.
Metals: D
Facilities:
Trademark: None

Illinois Lock Co., The
819 S. Ada
Chicago 7, Ill.
Metals: D
Facilities: 1, 2, 3, 5
Trademark: None

Indiana Steel Products Co., The
Valparaiso, Ind.
Metals: A (Alnico magnet housings only)
Facilities: 1, 2, 4, 5, 6
Trademark: None

Industrial Die Cast & Mfg. Co., Inc.
2980 N.W. 22nd
Miami, Fla.
Metals: A, B, D
Facilities: 2, 5
Tradename: I.D.C.O.
Trademark: None

Industrial Die Casting Co.
2300 N. Lister Ave.
Chicago 14, Ill.
Metals: A
Facilities: 2, 5
Trademark: See Section 3

Inland Die Casting Co., Inc.
8141 N. Lawndale
Skokie, Ill.
Metals: A
Facilities: 5
Trademark: None

Irrigation Equipment Co.
Industrial Div.
1300 Bethel Dr.
Eugene, Ore.
Metals: A, D
Facilities: 1, 2, 3, 4, 5, 6
Tradename: IRECO
Trademark: See Section 3

Irvington Die Casting Co.
133 S. 20
Irvington, N. J.
Metals: A, D
Facilities:
Trademark: None

J & F Tool & Die Casting Corp.
P. O. Box 175
Athens, Pa.
Metals: D
Facilities: 1, 2, 5
Trademark: See Section 3

For interpretation of all symbols, see page 94.

Art Jack Die Casters, Inc.
36 Goble
Newark 5, N. J.
Metals: D
Facilities: 1, 2
Trademark: None
Representatives: *Detroit, Mich.*, Lawrence B. Boensch, 18055 James Couzens Hwy.; *New York, N. Y.*, Ray Shafran, 125 W. 228, Alexander Sharenow, 133 W. 28, Michael Zamren, 75 Bank.

Jersey Plastic & Die Casting Co.* **
149 Shaw Ave.
Irvington 11, N. J.
Metals: A, D
Facilities: 1, 2
Trademark: None

Kadee Metal Products Co.
720 S. Grape
Medford, Ore.
Metals: A, D
Facilities: 1, 2, 4, 5, 6
Tradename: KADEE
Trademark: See Section 3

Kalamazoo Die Casting Co.
Mastenbrook Dr. & Milham Rd.
Kalamazoo, Mich.
Metals: A, D
Facilities: 1, 5
Trademark: See Section 3

Kamin Die Casting & Mfg. Co.*
3315 N. Knox Ave.
Chicago 41, Ill.
Metals: A, D
Facilities: 2, 5
Trademark: See Section 3

Kennedy Die Castings, Inc.
200 Harding
Worcester 4, Mass.
Metals: A, D
Facilities: 1, 5
Trademark: None

Mark Kenny Products Co., Inc.
251 E. 137
New York 51, N. Y.
Metals: D
Facilities: 1, 2, 5
Trademark: None

Kent Castings Corp.
200 Garden St., S.E.
Grand Rapids, Mich.
Metals: D
Facilities: 1, 2, 3, 5, 6
Tradename: Kencast
Trademark: See Section 3

Kiowa Corp.* **
1200 E. May
Marshalltown, Ia.
Metals: A, D
Facilities: 1, 2, 5
Tradename: Kiowa
Trademark: See Section 3

Kitchen-Quip, Inc.
E. Marion Street
Waterloo, Ind.
Metals: A
Facilities: 1, 3, 5, 6
Trademark: None

Kolsters Tool & Die
Building #315, Oakland Airport
Oakland, Cal.
Metals: A, D
Facilities: 1, 2, 5
Trademark: None

Paul Krone Die Casting Co.* **
1811 N. Kostner Ave.
Chicago 39, Ill.
Metals: A, D
Facilities: 2, 5
Trademark: See Section 3

Kwikset Locks, Inc.
516 E. Santa Ana
Anaheim, Cal.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Tradename: Kwikset
Trademark: See Section 3

Laboratory Equipment Corp.
Hilltop Rd., P. O. Box 151
St. Joseph, Mich.
Metals: D
Facilities: 1, 2, 3, 5, 6
Tradename: Leco
Trademark: See Section 3

Laco Die Casting Co.
23440 Lakeland Blvd.
Cleveland 23, O.
Metals: D
Facilities: 1, 5
Trademark: None

La France Precision Casting Co.
29th & McKean Sts.
Philadelphia 45, Pa.
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: None

Lake Center Switch Co.
51 Johnson
Winona, Minn.
Metals: D
Facilities: 1, 2, 5, 6
Trademark: None

Lakeshore Die Casting Ltd.
482 Queen Elizabeth Way
Oakville, Ont., Canada
Metals: A, D
Facilities: 1, 2, 5
Tradename: LAKESHORE
Trademark: See Section 3

Lansco Die Casting Co.
2029 N. Chico Ave.
El Monte, Cal.
Metals: A, D
Facilities: 1, 2, 5
Trademark: None

Latrobe Die Casting Co.*
Box 149
Latrobe, Pa.
Metals: A, D, E, F
Facilities: 2, 5
Trademark: See Section 3

Lester Castings, Inc.*
25661 Cannon Rd.
Bedford Heights, O.
Metals: A, C, D
Facilities: 2
Trademark: See Section 3

Lincoln Die Casting, Inc.
20805 Mound Rd.
Van Dyke, Mich.
Metals: D
Facilities: 5
Trademark: See Section 3

Litemetal Dicast, Inc.*
1927 Wildwood Ave.
Jackson, Mich.
Metals: A, C
Facilities: 2, 5
Trademark: See Section 3
Representatives: *Decatur, Ill.*, R. E. Dilatush, 1902 N. Broadway; *Evanston, Ill.*, George E. Wagner, 615 Sheridan Rd.; *Detroit, Mich.*, Robert J. Gaskill Co., 18550 Mack Ave., Frank E. Wickham Co., 19451 James Couzens Hwy.; *St. Paul, Minn.*, L. C. Newton, Inc., 1953 University Ave.; *Pittsburgh, Pa.*, R. L. Tate, 404 Frick Bldg.; *Wayne, Pa.*, Eddie Sawyer, Box 44; *Wauwatosa, Wis.*, Newton Snashall, 1306 N. 63 Ct.

Little Giant Vaporizer Co., Inc.
5101 Classen Blvd., Box 9545
Oklahoma City 18, Okla.
Metals: A
Facilities: 1, 5, 6
Trademark: See Section 3

Littler Diecast Corp.
P. O. Box 351, State Rd. 67
Albany, Ind.
Metals: A
Facilities: 2, 5
Trademark: See Section 3

Lloyd Products, Inc.* **
1790 University Ave.
St. Paul 4, Minn.
Metals: A, D
Facilities: 1, 2, 5, 6
Trademark: See Section 3

Logan Industries, Inc.
1640 W. Carroll Ave.
Chicago 12, Ill.
Metals: D
Facilities: 1, 2, 3, 5
Trademark: None
Representatives: *Villa Park, Ill.*, Wm. J. Reedy, 120 E. Oak.

Long Island Die Casting, Inc.
21 Smith
Inwood 96, L. I., N. Y.
Metals: D
Facilities: 1, 2, 5
Trademark: None

Los Angeles Die Casting Co.* **
340 Crocker
Los Angeles 13, Cal.
Metals: A, B, D
Facilities: 2, 5
Trademark: See Section 3

For interpretation of all symbols, see page 94.

Ludman Corp.
14100 Biscayne Blvd.
North Miami, Fla.
Metals: A, D
Facilities: 1, 2, 4, 6
Trademark: None

Lyons Diecasting Co.
Buckner, Mo.
Metals: D
Facilities: 1, 2, 5, 6
Trademark: None

Madison-Kipp Corp.* **
213 Waubesa
Madison, Wis.
Metals: A, D
Facilities: 1, 2, 4, 5
Tradename: KIPP
Trademark: See Section 3

Magnesium Industries, Inc.
1313 Kalamazoo
South Haven, Mich.
Metals: A, C
Facilities: 1, 2, 5, 6
Trademark: See Section 3

Manger Die Casting Co., Inc.
1 Maple
Shelton, Conn.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Manor Die Cast Corp.*
P. O. Box 386
Bedford, O.
Metals: A
Facilities: 2
Trademark: See Section 3

Jos. P. Manz Die Casting Co.
550 W. Beach Ave.
Inglewood 3, Cal.
Metals: A, C, D
Facilities: 1, 2, 4, 6
Trademark: None

L. E. Mason Co.*
98 Business
Hyde Park 36, Boston, Mass.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Master Fabricators, Inc.
6 Brooklyn Ave.
Massapequa, N. Y.
Metals: D
Facilities: 2, 4, 5
Trademark: None

Mendler Mfg. Co.
P. O. Box 125, Sandwich Postal Station
Windsor, Ont., Canada
Metals: D
Facilities: 1, 2, 5
Trademark: None

Metal-Cast Co.
620 16th Ave., W.
Birmingham, Ala.
Metals: A, D
Facilities: 1, 2, 5, 6
Trademark: None

Metal-X-Specialties Co., Inc.
5 E. Third
New York 3, N. Y.
Metals: D
Facilities: 2, 5
Trademark: None

Meta-Mold Aluminum Co.
Sub. of The Dayton Malleable Iron Co.
Cedarburg, Wis.
Metals: A, C
Facilities: 2, 4, 5
Tradename: Meta-Mold
Trademark: None

Micro-Products Engineering Co.
234-40 Ridgewood Ave.
Newark 8, N. J.
Metals: D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: None

Midwest Die Casting Co.* **
3930 N. First
Milwaukee 12, Wis.
Metals: D
Facilities: 2
Trademark: See Section 3

Mid-Western Die Casting Co.
1501 N. Halsted
Chicago 22, Ill.
Metals: A, D
Facilities: 1, 2, 5, 6
Trademark: See Section 3

Milwaukee Die Casting Co.* **
4132 N. Holton
Milwaukee 12, Wis.
Metals: A, D, E, F
Facilities: 2, 5
Tradename: Milwaukee
Trademark: See Section 3
Representatives: *Grosse Point, Mich.*, W. E. Osband, 721 Pemberton Rd.

Missouri Diecasting Co.*
1411 N. 17
St. Louis 6, Mo.
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

Modern Die Casting Corp.*
5419 N. Kedzie Ave.
Chicago 25, Ill.
Metals: A, D
Facilities: 2, 5
Trademark: None

Mohawk Die Casting Co.
Sub. of Mohawk Foundries, Inc.
55 First
Berea, O.
Metals: A
Facilities: 2, 4, 5, 6
Trademark: None

Monarch Aluminum Mfg. Co.* **
9205 Detroit Ave.
Cleveland 2, O.
Metals: A, D
Facilities: 1, 2, 4, 5
Tradename: MONARCAST and VELVAGLAZE
Trademark: See Section 3
Representatives: *Chicago, Ill.*, Gordon MaRugg, 5349 Fletcher; *Sparta, N. J.*, Manley S. Hutchinson, Box 1272; *Westlake, O.*, Joseph Shrier, 2441 Elmwood Dr.

Monarch Die Casting Corp.
1642 20th St.
Santa Monica, Cal.
Metals: A, D
Facilities: 1, 2, 5, 6
Trademark: None

Monarch Governor Co.
2800 Tyler Rd.
Willow Run, Mich.
Metals: D
Facilities: 1, 2, 5
Trademark: See Section 3

Monarch Tool & Machine Corp.
405 Second Ave.
New Hyde Park, L. I., N. Y.
Metals: D
Facilities: 1, 2, 5
Trademark: None

Monroe City Diecasting Co.
Monroe City, Mo.
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

Morton Mfg. Co.
7025 Sarpy Ave.
Omaha 7, Neb.
Metals: A, D
Facilities: 2, 3, 5
Trademark: None

Mortons Mfg. Co.
(Moderd Auto Accessories, Inc.)
141 W. Jefferson
Los Angeles 7, Cal.
Metals: D
Facilities: 1, 6
Trademark: None

Mt. Vernon Die Casting Corp.* **
Southfield Ave.
Stamford, Conn.
Metals: A, D
Facilities: 2, 5
Trademark: See Section 3
Representatives: *Stamford, Conn.*, Anker Anderson, Cascade Rd.; *East Orange, N. J.*, George E. Hahl, 39 S. Munn Ave.; *Rochester, N. Y.*, William Sauers, 101 Briarcliff Rd.; *Skaneateles, N. Y.*, Jerome J. Theobald, 9 E. Genesee; *Syracuse, N. Y.*, David H. King, 230 Grant Blvd.; *Cleveland, O.*, Grant Eller, 6 E. 194; *Philadelphia, Pa.*, Arthur Diamond, Tools Inc., 86 Bethlehem Pike.

A. B. Mueller & Co.
2101 E. John Ave.
St. Louis 7, Mo.
Metals: D
Facilities: 1, 2, 5
Trademark: None

**For interpretation of all symbols, see page 94.*

National Die Casting Co.
3635 W. Touhy Ave.
Chicago 45, Ill.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Trademark: None

National Hardware Specialties Ltd.
Box 250
Dresden, Ont., Canada
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

National Lead Co.* **
Doehler-Jarvis Div.
525 Cottage Grove, S. E.
Grand Rapids, Mich.
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3
Representatives: *Detroit, Mich.*, Robert L. Clark, Carl Van Driel, Robert L. Peterson, 3501 Griffin; *Grand Rapids, Mich.*, Steele A. Taylor, 525 Cottage Grove.

National Lead Co.*
Doehler-Jarvis Div.
Batavia, N. Y.
Metals: A, B, C
Facilities: 1, 2, 4, 5
Trademark: See Section 3
Representatives: *Batavia, N. Y.*, Edwin F. Chase, Wm. Heiler, Gordon Strunk, A. E. Swanson, c/o Doehler-Jarvis Div.

National Lead Co.* **
Doehler-Jarvis Div.
Dixie Hwy. & Williamont Rd.
Toledo, O.
Metals: A, D
Facilities: 3
Trademark: See Section 3

National Lead Co.* **
Doehler-Jarvis Div.
2100 Smead Ave.
Toledo, O.
Metals: A, D
Facilities: 1, 2, 4, 5
Trademark: See Section 3
Representatives: (Both Toledo, O. plants) *Chicago, Ill.*, G. Strohm, 5155 N. Natoma Ave.; *Clarendon Hills, Ill.*, C. Krehbiel, 20 Mohawk Dr.; *River Forest, Ill.*, W. L. Huber, P. O. Box 28; *Sylvania, O.*, G. Kozlowski, 6136 Sylvan Green Rd.; *Toledo, O.*, F. W. Burgie, Jr., 3214 Westchester Dr., J. Emens, 3655 Beechway Blvd., R. Harloff, 1835 Cone, C. I. Hodgson, 1123 Hawk, A. Kohn, 749 Waybridge, J. L. O'Brien, 2824 Cheltenham Rd., J. Ruffin, 2909 Kenwood Blvd., E. Warner, 3730 Stannard Dr.

National Lead Co.* **
Doehler-Jarvis Div.
Pottstown, Pa.
Metals: A, D
Facilities: 1, 2, 4, 5, 6
Trademark: See Section 3
Representatives: *North Haven, Conn.*, J. R. Loughran, 1031 Hartford Tnpk.; *Needham, Mass.*, A. F. Saylor, 18 Longfellow Rd.; *Livingston, N. J.*, G. F. Huff, 299 Hillside Ave.; *Westfield, N. J.*, J. R. Yocom, 355 W. Dudley Ave.; *Pottstown, Pa.*, H. K. Guldin, 842 N. Evans, D. S. Skean, 1010 Feist Ave.

National Lock Co.
1902 Seventh St.
Rockford, Ill.
Metals: D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: See Section 3

National Ornament Co.
6517 14th Ave.
Brooklyn 19, N. Y.
Metals: D
Facilities: 1, 2, 5
Trademark: None

Nelmor Mfg. Corp.
26420 Lakeland Blvd.
Euclid, O.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Trademark: None

Nelson Metal Products, Inc.*
510 32nd Street
Grand Rapids, Mich.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

New England Die Casting Co., Inc.
445 Front Ave.
West Haven, Conn.
Metals: A, D
Facilities: 1, 2, 4, 5
Trademark: See Section 3
Representatives: *New Haven, Conn.*, Chas. W. Ohse, P. O. Box 1281; *North Haven, Conn.*, J. D. MacWilliam, 1066 Hartford Turnpike; *Watertown, Conn.*, D. E. Evans, 41 Cutler; *Boston, Mass.*, B. W. Baird, 248 Boylston; *New York, N. Y.*, Harry A. Rankow, 175 Fifth Ave., Edgar L. Strauss, 108 E. 86.

New England Tool Corp.
53 Houghton
Hudson, Mass.
Metals: A, D
Facilities: 1, 2, 5
Trademark: None

New Products Corp.* **
448 North Shore
Benton Harbor, Mich.
Metals: A, C, D
Facilities: 2, 3, 5, 6
Trademark: See Section 3

Newton Industries, Inc.
100 Saw Mill Rd.
West Haven, Conn.
Metals: D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: None

Newton-New Haven Co., The* **
Third Avenue
West Haven, Conn.
Metals: A, D
Facilities: 1, 2, 3, 4, 5, 6
Tradename: NEWTON-NEW HAVEN
Trademark: See Section 3

Nordon Die Casting Co., Inc.*
30 N. Eighth Ave.
Maywood, Ill.
Metals: A, D
Facilities: 2, 5
Trademark: See Section 3

Northern Iowa Die Casting Co.
1706 Ithaca Ave.
Spirit Lake, Ia.
Metals: D
Facilities: 1, 2, 5, 6
Trademark: None

Norwood Tool & Machine Co.
900 Wood
Three Rivers, Mich.
Metals: A, D
Facilities: 1, 2, 5, 6
Tradename: NORWOOD
Trademark: See Section 3

Ohio Die Casting Corp.
266 E. Fifth Ave.
Columbus 1, O.
Metals: A, D
Facilities: 1, 3, 5, 6
Trademark: See Section 3

Ontario Steel Products Co. Ltd.
Die Casting Div.
Chatham, Ont., Canada
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Oswego Castings Corp.*
Box 222
Oswego, N. Y.
Metals: A
Facilities: 1, 2, 4
Trademark: See Section 3

Pabcast*
355 W. Olive
Gardena, Cal.
Metals: A
Facilities: 2
Tradename: PABCAST
Trademark: None

Page & Hall Mfg. Co., Inc.
1600 Hyde Park Ave.
Boston 36, Mass.
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

Pagliuso Engineering Co.
113 W. Harvard
Glendale 4, Cal.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Tradename: PAGCO
Trademark: None

For interpretation of all symbols, see page 94.

Paragon Die Casting Co.* **
5851 W. Dickens Ave.
Chicago 39, Ill.
Metals: A, D
Facilities: 2, 3, 5
Trademark: See Section 3

Paramount Die Casters, Inc.
Freeman Field
Seymour, Ind.
Metals: A, D
Facilities: 5
Trademark: None

Paramount Die Casting Co.*
U. S. 12
St. Joseph, Mich.
Metals: A, C, D
Facilities: 1, 2, 5
Tradename: None
Trademark: See Section 3
Representatives: *Detroit, Mich.*, C. R. Hoofnagle, 18264 James Couzens Hwy.; *Flint, Mich.*, Michigan Products Co., G-4381 S. Saginaw St.; *Cleveland, O.*, Arthur E. Hills Co., 316 Marion Rd.; *Milwaukee, Wis.*, Frank L. Young, Room 6132 Plankington Bldg.

Paramount Die Casting Products Co.
8313 E. Ten Mile Rd.
Centerline, Mich.
Metals: D
Facilities: 1, 2, 3
Trademark: None

Parker White Metal Co.* **
2153 McKinley Ave.
Erie, Pa.
Metals: A, D
Facilities: 2, 5
Trademark: See Section 3
Representatives: *Wilton, Conn.*, G. L. Palmer, Belden Hill Rd.; *Chicago, Ill.*, Ollie J. Berger Co., 2059 E. 72; *Detroit, Mich.*, Hodgson-Geisler Co., 18917 James Couzens Hwy.; *Kirkwood, Mo.*, Edward F. Higgins, Jr., 102 W. Adams; *Syracuse, N. Y.*, J. C. Palmer, 712 State Tower Bldg.; *Cincinnati, O.*, Wm. H. Broxterman, 2174 Buck; *Bellefonte, Pa.*, Warren G. Olson, 420 E. Linn; *Girard, Pa.*, Daniel F. Marsh, 35 Chestnut.

Peasley Products, Inc.* **
993 Honeyspot Rd.
Stratford, Conn.
Metals: A, D
Facilities: 5
Trademark: None

Peat Mfg. Co.* **
Div. of Textron, Inc.
10700 E. Firestone Blvd.
Norwalk, Cal.
Metals: A, D
Facilities: 1, 5
Trademark: See Section 3

Peerless Aluminum Foundry Co., Inc.*
Peerless Die Casting & Permold Div.
55 Andover
Bridgeport, Conn.
Metals: A
Facilities: 2, 4, 5
Trademark: See Section 3
Representatives: *Derby, Conn.*, Walter Billings, Indian Ave.

Peterson's Machine Shop
Russell St. Ext.
Lewiston, Me.
Metals: A, D
Facilities: 1, 2, 5
Trademark: None

Petoskey Mfg. Co.
200 W. Lake
Petoskey, Mich.
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Ben Phillips Nameplates
11556 Vanowen
North Hollywood, Cal.
Metals: D
Facilities: 2, 6
Trademark: None

Phoenix Die Casting Co.* **
21 Illinois
Buffalo 3, N. Y.
Metals: D
Facilities:
Trademark: See Section 3

Pierson Machine Co.
c/o Ridge Door Co.
Monmouth Junction, N. J.
Metals: D
Facilities: 1, 2, 5
Trademark: None

Pioneer Diecasters, Inc.* **
4209 Chevy Chase Dr.
Los Angeles 39, Cal.
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

Pittsburgh Die & Casting Co.*
7503 Ardmore
Swissvale, Pittsburgh 18, Pa.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

A. O. Pope Ltd.
90 Winter
Saint John, N. B., Canada
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

Precision Castings Co.* **
Div. of Harsco Corp.
2025 Kishwaukee
Rockford, Ill.
Metals: A, D
Facilities: 1, 2, 4, 5
Trademark: See Section 3
Representatives: *Chicago, Ill.*, C. O. Hogland, 549 W. Washington Blvd., Edmond Steffey, 8250 St. Lawrence Ave.; *Rockford, Ill.*, Roy T. Jacobson, 722 Lundvall Ave.; *Lansing, Mich.*, Wally C. Pipp, 2004 Cumberland Rd.; *St. Louis, Mo.*, Edmond Stempfle, 8544 N. Broadway; *Brookfield, Wis.*, Richard L. Downing, 1625 Spring Dr.

Precision Castings Co.* **
Div. of Harsco Corp.
12600 Berea Rd.
Cleveland, O.
Metals: A, D
Facilities: 1, 2, 4, 5
Trademark: See Section 3
Representatives: *Cleveland, O.*, R. W. Castle, 1287 West Boulevard; *Parma Heights, O.*, Arthur Witt, 6355 Delrose Dr.; *Rocky River, O.*, J. Ford Ackroyd, 2547 Hampton Rd.

Precision Castings Co.* **
Div. of Harsco Corp.
5959 Howard
Chicago 31, Ill.
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3
Representatives: *Chicago, Ill.*, Harry Spaet, 6902 N. Tonty Ave.; *Glenview, Ill.*, Harry Jagade, 929 Beaver Lane, T. H. Pickering, 641 Glendale Dr.

Precision Castings Co.* **
Div. of Harsco Corp.
P. O. Drawer 1077
Syracuse 1, N. Y.
Metals: A, C, D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: See Section 3
Representatives: *River Edge, N. J.*, Vernon B. Ressler, 176 Greenway Terrace; *DeWitt, N. Y.*, Boyden W. Hindman, 301 Ambergate Rd.; *Fayetteville, N. Y.*, Gordon C. Curry, 12 Lyndon Rd., James J. Jennings, Jr., 201 Spring; *Pittsford, N. Y.*, Phillip Surdyke, 10 Santa Rd., R. D. #1; *Cranston, R. I.*, Clarence Fuehrer, 30 Lockwood.

Premier Die Casting Co.*
28 Margaretta
Newark, N. J.
Metals: A, D
Facilities: 1, 2, 4, 5
Trademark: See Section 3

Pressco Casting & Mfg. Corp.
Broadway & Waverly Rd.
Chesterton, Ind.
Metals: B
Facilities: 1, 2, 3, 5
Tradename: Pressco
Trademark: See Section 3

Pressure Castings, Inc.* **
21500 St. Clair Ave.
Cleveland 19, O.
Metals: A, D
Facilities: 2, 3, 5, 6
Trademark: See Section 3

For interpretation of all symbols, see page 94.

Representatives: *Indianapolis, Ind.*, John D. Goodin, 3675 Washington Blvd.; *Boston, Mass.*, I. L. Bambrick, Sheraton Plaza Hotel; *Detroit, Mich.*, R. E. Zimmermann & Sons, 718 Fisher Bldg.; *Rochester, N. Y.*, Hanna & Ferguson, 75 Winton Rd., S.; *Eaton, O.*, Manufacturers Sales Associates, 202 Preble County Bank Bldg., P. O. Box 261.

Pressure Castings Of Canada Ltd.
67 Main St., S.
Weston, Toronto 15, Ont., Canada
Metals: A, D
Facilities: 1, 2, 3, 5
Trademark: See Section 3

Product Engineering Co.
4707 S. E. 17
Portland 2, Ore.
Metals: A, D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: See Section 3

Product Engineering & Mfg. Corp.
Box 57
Bridgman, Mich.
Metals: A, D
Facilities: 1, 2, 3, 5
Tradename: PEMCO
Trademark: See Section 3

Production Die Casting Co.*
6502 Rusk Ave.
Houston 11, Tex.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Production Mold & Machine Co.
2112 Leota
Huntington Park, Cal.
Metals: D
Facilities: 1, 2, 5
Trademark: None

Production Specialties Co.
Higgins Lane
Georgiaville, R. I.
Metals: D
Facilities: 1, 5
Trademark: None

Quad City Die Casting Co.
3800 River Dr.
Moline, Ill.
Metals: A, D
Facilities: 2, 5
Trademark: None

Racine Die Casting Co.* **
1500 16th Street
Racine, Wis.
Metals: A, D
Facilities: 2, 5
Trademark: See Section 3

Rangers Die Casting Co., Inc.*
10828 S. Alameda
Lynwood, Cal.
Metals: A
Facilities: 2, 5
Trademark: See Section 3

Reese Padlock Co.
128 Sherman
Lancaster, Pa.
Metals: D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: None

A. C. Rehberger Co.
2134 N. Magnolia
Chicago 14, Ill.
Metals: B, D
Facilities: 1, 3, 5
Tradename: REH-CRAFT
Trademark: None

Republic Die Casting Co.* **
611 Talcott Ave.
St. Louis 7, Mo.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Reuhl Products, Inc.
4505 W. Beltine Hwy.
Madison, Wis.
Metals: D
Facilities: 1, 2, 4, 5, 6
Trademark: None

Richmond Machine Tool & Die Casting Co. Ltd.
165 St. Zotique St., W.
Montreal 10, Que., Canada
Metals: A, D
Facilities: 2, 3, 4, 5, 6
Trademark: See Section 3

Roberts Engineering & Mfg. Co., Inc.
640 Navigation Blvd., Box 4060
Corpus Christi, Tex.
Metals: A, D
Facilities: 1, 2, 5
Trademark: None

Romada Tool & Mfg. Co.
9536 Dearborn Ave.
Detroit 9, Mich.
Metals: D
Facilities: 1, 2, 5, 6
Trademark: None

Ross Sprinkler Co., The
4333 Temple City Blvd.
Rosemead, Cal.
Metals: D
Facilities: 1, 5
Tradename: Ross #11
Trademark: None

Rowe Plastics & Die Casting Co.
955 W. Schubert Ave.
Chicago 14, Ill.
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

Ruffe, Inc.
7525 N. W. 37th Ave.
Miami, Fla.
Metals: A
Facilities: 1, 2, 3, 4, 5, 6
Trademark: None

Rupert Diecasting Co.*
1655 Cleveland Ave.
Kansas City 27, Mo.
Metals: A, D
Facilities:
Trademark: See Section 3

Rutherford Bros. Plating Co.
7 Emerick (Plant)
318 E. Cross (Mailing Address)
Ypsilanti, Mich.
Metals: D
Facilities: 1, 3, 6
Trademark: None

S.U.S. Die Casting Co., Inc.
41 E. Market
Logansport, Ind.
Metals: A
Facilities: 1, 2, 5
Trademark: See Section 3

Saginaw Bay Industries, Inc.
242 N. Water
Bay City, Mich.
Metals: A, C
Facilities: 1, 4, 5, 6
Trademark: See Section 3

St. Louis Diecasting Corp.* **
4528 Oleatha Ave.
St. Louis 16, Mo.
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

San Jose Die Casting Corp.
815 Chestnut
San Jose 10, Cal.
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

Scherer Mfg. Co.
Alyce Ave.
Cedarburg, Wis.
Metals: A
Facilities: 2, 5
Trademark: See Section 3

Geo. O. Schilling Bronze Co.
202-216 E. North
Rome, N. Y.
Metals: A, B, D
Facilities: 2, 3, 4, 5, 6
Tradename: Schilbrass
Trademark: See Section 3

K. E. Schoell Co.
764 N. W. 75th St.
Miami, Fla.
Metals: D
Facilities:
Trademark: None

Schultz Die Casting Co.* **
1810 Clinton
Toledo 7, O.
Metals: D
Facilities: 2, 5
Trademark: See Section 3

Schultz Die Casting Co. of Canada Ltd.* **
Wallaceburg, Ont., Canada
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

For interpretation of all symbols, see page 94.

Seaboard Diecasting Corp.
1125 Prospect Ave.
West Islip, L. I., N. Y.
Metals: D
Facilities: 1, 2, 3, 5
Trademark: See Section 3

Sheldon Die Casting Co.
859 N. Prior Ave.
St. Paul, Minn.
Metals: A, D
Facilities: 2, 5
Trademark: None

Sherman Pressure Casting Corp.
601 W. 26
New York 1, N. Y.
Metals: A, C, D
Facilities: 1, 2, 4, 5
Trademark: See Section 3
Representatives: *New York, N. Y.*, Ben Ellins, 159-00 Riverside Drive.

Lee Silver Service, Inc.
13561 Helen
Detroit, Mich.
Metals: D
Facilities: 1, 3, 5, 6
Trademark: See Section 3

Soper Mfg. Co.
1099 Milton
Benton Harbor, Mich.
Metals: D
Facilities: 2, 5
Trademark: See Section 3

Southern California Plating Co. U. S. License Frame Mfg. Co. & Mfg. Div.
3436 San Fernando Rd.
Los Angeles 65, Cal.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Tradename: U. S. BRAND
Trademark: None

J. W. Speaker Corp.
3059 N. Weil
Milwaukee 12, Wis.
Metals: D
Facilities: 1, 6
Trademark: See Section 3

Speedmaster Engineering Co.
900 Doolittle Dr.
San Leandro, Cal.
Metals: A, B, D
Facilities: 1, 5
Trademark: None

Springfield Die Casting Co., Inc.*
721 Lexington Ave.
Kenilworth, N. J.
Metals: D
Facilities: 1, 2, 5
Trademark: None
Representatives: *Kenilworth, N. J.*, P. G. Nase, 721 Lexington Ave.

Stella Products Corp.*
66 Okner Pkwy.
Livingston, N. J.
Metals: D
Facilities: 1, 5
Trademark: See Section 3

Stemac, Inc.* **
1277 S. Cherokee
Denver 23, Colo.
Metals: D
Facilities: 1, 2, 4, 5, 6
Tradename: Stemac
Trademark: See Section 3

M. Stephens Mfg., Inc.
814 E. 29
Los Angeles 11, Cal.
Metals: D
Facilities: 1, 2, 5
Trademark: None

Sterling Aluminum Products, Inc.
2600 N. Third
St. Charles, Mo.
Metals: A
Facilities: 2, 4, 5
Trademark: See Section 3

Sterling Die Casting Co., Inc.* **
743 39th St.
Brooklyn 32, N. Y.
Metals: A, D
Facilities: 2, 5
Trademark: See Section 3

J & E Stevens Co.
Nooks Hill Rd.
Cromwell, Conn.
Metals: D
Facilities: 1, 3, 5, 6
Trademark: None

Stevens Mfg. Co.
Byron, Ill.
Metals: D
Facilities: 1, 3, 5, 6
Trademark: None

Stewart-Warner Corp.* **
Stewart Die Casting Div.
275 Warren
Bridgeport, Conn.
Metals: A, D
Facilities: 1, 2, 3, 4, 5, 6
Tradename: STEWART
Trademark: See Section 3

Stewart-Warner Corp.* **
Stewart Die Casting Div.
4535 W. Fullerton Ave.
Chicago, Ill.
Metals: A, C, D
Facilities: 1, 2, 4, 5
Trademark: See Section 3

Strite-Anderson Mfg. Co.
1920 Washington Ave., S.
Minneapolis, Minn.
Metals: A, D
Facilities: 1, 2, 5, 6
Trademark: None

Stroh Die Casting Co., Inc.* **
11123 W. Burleigh
Milwaukee 10, Wis.
Metals: D
Facilities: 2, 5
Trademark: See Section 3

Superba Die Castings
Box 147
Ft. Recovery, O.
Metals: D
Facilities: 1, 5, 6
Trademark: None

Super Grip Anchor Bolt Co., Inc.
3333 N. 22
Philadelphia 40, Pa.
Metals: A, D
Facilities: 1, 5, 6
Trademark: See Section 3

Superior Die Casting Co., The* **
1001 London Rd.
Cleveland 10, O.
Metals: A, D
Facilities: None
Tradename: SuperCast
Trademark: See Section 3

Syracuse Die Casting & Mfg. Co.
2101 Teall Ave.
East Syracuse, N. Y.
Metals: A, D
Facilities: 2, 5
Trademark: None

T Die Cast & Molded Products
11627 S. Main
Los Angeles 61, Cal.
Metals: A, D
Facilities: 1, 2, 5
Tradename: TEE
Trademark: See Section 3

Tann Corp.* **
Congress Die Casting Div.
3750 E. Outer Dr.
Detroit 34, Mich.
Metals: D
Facilities: 1, 3, 5, 6
Trademark: See Section 3

Techni-Cast Corp.* **
600-608 Walnut
Hamilton, O.
Metals: A, D
Facilities: 2, 5
Tradename: TECHNI-QUALITY
Trademark: See Section 3

Thompson Products, Inc.*
Light Metals Div.
2269 Ashland Rd.
Cleveland 3, O.
Metals: A, C
Facilities: 4, 5
Trademark: See Section 3
Representatives: *Chicago, Ill.*, Zitzewitz & Crew, 700 N. Michigan Ave.; *Davenport, Ia.*, R. F. Harrington, 2802 E. 46; *Winchester, Mass.*, Cort Campbell, 9 Cabot; *St. Louis, Mo.*, Paul B. Prough, 9929 Manchester Ave.; *Maplewood, N. J.*, Ted A. Harper, 1809 Springfield Ave.; *Summit, N. J.*, John J. O'Sullivan, 5 Lafayette Ave.; *Rochester, N. Y.*, Stampress Engineering, 468 Monroe Ave., P. O. Box 545; *Cincinnati, O.*, R. M. Craver, 6973 Glenmeadow Ave.; *Cleveland, O.*, Industrial Distributors, Inc., 3136 W. 25; E. H. Schroeter, 2269 Ashland Rd.; *Duquesne, Pa.*, Robert J. Rodgers, 101 Homestead.

For interpretation of all symbols, see page 94.

Titan Metal Mfg. Co.*
Bellefonte, Pa.
Metals: A, B
Facilities: 1, 2, 4, 5
Tradename: Titan
Trademark: See Section 3
Representatives: *Los Angeles, Cal.*, Clarence F. Herrmann Co., 420 S. San Pedro; *San Francisco, Cal.*, David Winslow Co., 25 California; *Denver, Colo.*, Paul Spencer & Co., Inc., 4000 York; *Atlanta, Ga.*, Marion T. Davis & Co., 281 North Ave., N.E.; *Washington, D. C.*, C. L. Miller, Washington Bldg.; *Chicago, Ill.*, H. T. Habermann, 53 W. Jackson Blvd.; *Indianapolis, Ind.*, B. F. Thompson, Jr., 2200 S. Tibbs Ave.; *New Orleans, La.*, John B. Church, Sr., P. O. Box 4234; *Detroit, Mich.*, W. F. Pioch, Jr., 1457 National Bank Bldg.; *St. Paul, Minn.*, L. C. Newton, Inc., 1953 University Ave.; *St. Louis, Mo.*, R. J. Hayes, 3920 Lindell Blvd.; *Camden, N. J.*, Claude F. Leaman, Jr., 320 Wilson Bldg.; *New York, N. Y.*, Hooper-Byrne Co., 30 Cortlandt; *Cincinnati, O.*, G. L. Furey, 405 Union Central Bldg.; *Cleveland, O.*, L. E. Vail, 14812 Detroit Ave.; *Toledo, O.*, F. D. Haigh, 2625 Juniper Dr.; *Dallas, Tex.*, Donald R. Church, P. O. Box 13344; *Houston, Tex.*, John B. Church, Jr., 905 Live Oak; *Salt Lake City, Utah*, Paul R. Spencer & Co., Inc., 400 Dooly Bldg.; *Seattle, Wash.*, James Allison, 6600 Airport Way.

Tool-Die Engineering Co., The* **
9210 Loren Ave.
Cleveland 5, O.
Metals: A, D
Facilities: 5
Trademark: See Section 3

E. Toman & Co.
8700 W. 47
Lyons, Ill.
Metals: A, D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Tri-State Die Casting Corp.
P. O. Box 337
Henderson, Ky.
Metals: A, D
Facilities: 1, 2, 4, 5, 6
Trademark: None

Turner Mfg. Co., Inc.
404 W. Superior
Kokomo, Ind.
Metals: E
Facilities: 1, 2, 5
Trademark: See Section 3

Tuttle Electric Products, Inc.
Kirkland, Ill.
Metals: D
Facilities: 1, 3
Trademark: None

**Twin City Die Castings Co.* **
Talmage & 33rd Ave., S.E.
Minneapolis 14, Minn.
Metals: A, D
Facilities: 1, 2, 5
Trademark: See Section 3

Union Die Casting Co.* **
676 Putnam Dr.
Whittier, Cal.
Metals: A, D
Facilities: 1, 2, 4, 5, 6
Tradename: UDICO
Trademark: See Section 3

Univex Die Cast & Engineering Co.
7001 Chase Rd.
Dearborn, Mich.
Metals: D
Facilities: 1, 2, 3, 5, 6
Trademark: See Section 3

Vacuum Die Casting Corp., The
Foot of Pacific St.
Newark 5, N. J.
Metals: A, D
Facilities: 1, 2, 5
Trademark: None

Varland Metal Service, Inc.
1350 Arlington
Cincinnati 25, O.
Metals: A, D
Facilities: 2, 3, 5, 6
Trademark: None

Waterbury Lock & Specialty Co., The
203 Broad
Milford, Conn.
Metals: D
Facilities: 1, 2, 3, 4, 5, 6
Tradename: WALSCO
Trademark: None

Wayland Co.
2632 W. Grand Ave.
Chicago 12, Ill.
Metals: D
Facilities: 1, 2, 5
Trademark: None

Webarm Diecasting, Inc.
71 Montaup
Fall River, Mass.
Metals: A, D
Facilities: 2, 5
Tradename: Color-Cast
Trademark: None

Wells Die Casting Co. of California* **
43 Dore
San Francisco 3, Cal.
Metals: A, B, D
Facilities: 1, 2, 5
Trademark: See Section 3

Wells Mfg. Co., Inc.
New Vienna, O.
Metals: D
Facilities: 1, 6
Trademark: None

West Irving Die Casting Co.*
240 S. Evergreen
Bensenville, Ill.
Metals: A
Facilities: 1, 2, 5
Trademark: See Section 3

Western Die Casting Co.* **
4065 Hollis
Emeryville 8, Cal.
Metals: A, B, C, D
Facilities: 1, 2, 5
Trademark: See Section 3

Westland Die Casting * **
Div. of Westland Tool & Mfg. Co.
4617 Sperry
Los Angeles 39, Cal.
Metals: A, B, C, D
Facilities: 1, 2, 5
Trademark: See Section 3

Wheaton Die Casting Corp.* **
Millville, N. J.
Metals: A, D
Facilities: 2, 5, 6
Trademark: None

White Die Casting Co.
Dundas, Ont., Canada
Metals: A, D
Facilities: 1, 2, 3, 4, 5, 6
Trademark: See Section 3

Whitehead Die Casting Co.
1140 Zonolite Rd., N.E.
Atlanta 6, Ga.
Metals: A, D, E
Facilities: 1, 2, 5
Tradename: ATLAS
Trademark: None

Withrow Die Casting Co.* **
13164 Leadwell
North Hollywood, Cal.
Metals: A, B, D
Facilities: 1, 2, 5
Trademark: None

Wolverine Die Cast Corp.
13700 Mt. Elliott
Detroit 12, Mich.
Metals: D
Facilities: 1, 2, 3, 5
Trademark: None

Wright Engineering & Supply Co.
1300 S. Bannock
Denver 23, Colo.
Metals: A, C
Facilities: 1, 2, 3, 5, 6
Trademark: None

Yoder Die Casting Corp.* **
727 Kiser
Dayton 4, O.
Metals: A
Facilities: 3, 5, 6
Trademark: See Section 3

ZYX Die Casting Co.
Greensboro, N. C.
Metals: D
Facilities: 1
Trademark: See Section 3

Zenith Diecasting, Inc.
5164 Alcoa Ave.
Los Angeles 58, Cal.
Metals: A, B, D
Facilities: 1, 2
Trademark: See Section 3

**For interpretation of all symbols, see page 94.*

GEOGRAPHICAL LISTING

ALABAMA

Birmingham
Metal-Cast Co., 620 16th Ave., W.

Florence
Alabama Wire Co., Inc., Sycamore & Terrace Sts.

ARKANSAS

Fort Smith
Eastern Metal Products Corp., Box 852, Chaffee Access Rd.

Harrison
Arkansas Die Casting Co., Box 748

Little Rock
Hamlin Products, Inc., 7600 Asher Ave,, P. O. Box 2016

Malvern
General Motors Corp., Fabricast Div., P. O. Box 211

CALIFORNIA

Anaheim
Kwikset Locks, Inc., 516 E. Santa Ana

Berkeley
Benda Tool & Model Works, 1444 Fourth St.

Burbank
Bucy Mfg. Co., 625 S. Glenwood Pl.

Culver City
Robert A. Cox Die Casting Co., 11418 Knightsbridge Ave.

El Cajon
El Cajon Die Casting & Mfg. Co., 590 Marshall Ave.

El Monte
El Monte Tool & Die Casting, Inc., 10948 Schmidt Rd.

Lansco Die Casting Co., 2029 N. Chico Ave.

Emeryville
Western Die Casting Co., 4065 Hollis

Gardena
A & A Die Casting Co., 12901 S. Western Ave.
Die Cast Products, Inc., 621 W. Rosecrans Ave.
Pabcast, 355 W. Olive

Glendale
Ambrit Industries, Inc., 1288 Los Angeles
Pagliuso Engineering Co., 113 W. Harvard

Harbor City
Advanced Manufacturing, Inc., 1214 W. 254

Huntington Park
Production Mold & Machine Co., 2112 Leota

Inglewood
Jos. P. Manz Die Casting Co., 550 W. Beach Ave.

Los Angeles
Acme Tool & Die Casting Co., 4250 E. Washington Blvd.
Alloy Die Casting Co., 2211 Firestone Blvd.
Aluminum Die Casting Co., 3452 San Fernando Rd.
Anderson Die Casting & Engineering Co., 1000 E. 60
Atlas Auto Products, Inc., 5815 Wilmington Ave.
Cannon Electric Co., 3209 Humbolt
Challenger Lock Co., Inc., 4865 Exposition Blvd.
Harvill Corp., 6251 W. Century Blvd.
Los Angeles Die Casting Co., 340 Crocker
Mortons Mfg. Co., Moderd Auto Accessories, Inc.), 141 W. Jefferson
Pioneer Diecasters, Inc., 4209 Chevy Chase Dr.
Southern California Plating Co., U. S. License Frame Mfg. Co. & Mfg. Div., 3436 San Fernando Rd.
M. Stephens Mfg., Inc., 814 E. 29
T Die Cast & Molded Products, 11627 S. Main
Westland Die Castings, Div. of Westland Tool & Mfg., Co., 4617 Sperry
Zenith Diecasting, Inc., 5164 Alcoa Ave.

Lynwood
Rangers Die Casting Co., Inc., 10828 S. Alameda

North Hollywood
Ben Phillips Nameplates, 11556 Vanowen
Withrow Die Casting Co., 13164 Leadwell

Norwalk
Peat Mfg. Co., Div. of Textron, Inc., 10700 E. Firestone Blvd.

Oakland
Casper's Machine Shop 1047-77th Ave.
Kolsters Tool & Die, Building #315, Oakland Airport

Pasadena
W. L. Chapman Co., 2886 E. Walnut

Rivera
J. E. Dietz Mfg. Co., 9216 Bermudez

Rosemead
Ross Sprinkler Co., The, 4333 Temple City Blvd.

San Francisco
Wells Die Casting Co. of California, 43 Dore

San Jose
San Jose Die Casting Corp., 815 Chestnut

San Leandro
Speedmaster Engineering Co., 900 Doolittle Dr.

Santa Monica
Monarch Die Casting Corp., 1642 20th St.

South Gate
Colbert Die Cast Co., 5416 Tweedy Blvd.
DeRoy Mfg. Co., 9208 Atlantic Ave.

Whittier
Union Die Casting Co., 676 Putnam Dr.

COLORADO

Denver
Gemco Mfg. Co., 501 S. Lipan
Stemac, Inc., 1277 S. Cherokee
Wright Engineering & Supply Co., 1300 S. Bannock

CONNECTICUT

Bridgeport
Peerless Aluminum Foundry Co., Inc., Peerless Die Casting & Permold Div., 55 Andover
Stewart-Warner Corp., Stewart Die Casting Div., 275 Warren

Cromwell
J & E Stevens Co., Nooks Hill Rd.

Milford
Waterbury Lock & Specialty Co., The, 203 Broad

Plantsville
Bruce Mfg. & Molding Co., Inc., Atwater St.

Shelton
Manger Die Casting Co., Inc., 1 Maple

Stamford
Conetta Tool & Die Co., Inc., 73 Sunnyside Ave.
Mt. Vernon Die Casting Corp., Southfield Ave.

Stratford
Peasley Products, Inc., 993 Honeyspot Rd.

West Haven
New England Die Casting Co., Inc., 445 Front Ave.
Newton Industries, Inc., 100 Saw Mill Rd.
Newton-New Haven Co., The, Third Ave.

FLORIDA

Miami
Die Casting Corp. of Florida, 3000 N. W. 75
Industrial Die Cast & Mfg. Co., Inc., 2980 N.W. 22nd
Ruffe, Inc., 7525 N. W. 37th Ave.
K. E. Schoell Co., 764 N. W. 75 St.

North Miami
Ludman Corp., 14100 Biscayne Blvd.

GEORGIA

Atlanta
Whitehead Die Casting Co., 1140 Zonolite Rd., N.E.

ILLINOIS

Aurora
Aurora Metal Co., 614 W. Park Ave.

Barrington
Barrington Tool & Engineering Co., 335 E. Station

Bellwood
Aluminum Company of America, Madison & Mannheim Rd.

Bensenville
West Irving Die Casting Co., 240 S. Evergreen

Byron
Stevens Mfg. Co.

Chicago
ABCO Die Casting Corp., 330 N. Harding Ave.
Ability Die Casting, 865 N. Sangamon
Admiral Die Castings, A Div. Portable Electric Tools, Inc., 250 W. 83
Albany Plating & Die Casting Co., 464 W. 33
Anderson Tool & Mfg. Co., 3450 N. Kostner Ave.
Atomic Die Casting Corp., 7817 S. Claremont Ave.
Banthrico Industries, Inc., 17 N. Desplaines
Central Die Casting & Mfg. Co., Inc., 2935 W. 47
Century Die Casting Co., 2629 W. Fletcher
Chicago Die Casting Mfg. Co., 2510 W. Monroe
Chicago Expansion Bolt Co., 1338 W. Concord Pl.
Chicago White Metal Casting, Inc., 5239 W. Grand Ave.
DeCardy Bros. Co., 1806 N. Keeler Ave.
Dialoy, Inc., 214 S. Clinton
Eklind Tool & Mfg. Co., 2627 N. Western Ave.
Enhorning Industries, 2013 W. 69
Federal Die Casting Co., 2220 Elston Ave.
Hayden Mfg. Co., 173 N. Peoria
Heick Die Casting Corp., 6550 W. Diversey Ave.
Illinois Lock Co., The, 819 S. Ada
Industrial Die Casting Co., 2300 N. Lister Ave.
Kamin Die Casting & Mfg. Co., 3315 N. Knox Ave.
Paul Krone Die Casting Co., 1811 N. Kostner Ave.
Logan Industries, Inc., 1640 W. Carroll Ave.
Mid-Western Die Casting Co., 1501 N. Halsted
Modern Die Casting Corp., 5419 N. Kedzie Ave.
National Die Casting Co., 3635 W. Touhy Ave.
Paragon Die Casting Co., 5851 W. Dickens Ave.
Precision Castings Co., Div. of Harsco Corp., 5959 Howard
A. C. Rehberger Co., 2134 N. Magnolia
Rowe Plastics & Die Casting Co., 955 W. Schubert Ave.
Stewart-Warner Corp., Stewart Die Casting Div., 4535 W. Fullerton Ave.
Wayland Co., 2632 W. Grand Ave.

Elmwood Park
Grand Die Casting, Inc., 7936 W. Grand Ave.

Fairfield
Airtex Products, Inc.

Hamilton
Ehrhart Die Casting Co., K.O.K.X. Road

Kirkland
Tuttle Electric Products, Inc.

Lyons
E. Toman & Co., 8700 W. 47

Maywood
Callen Mfg. Corp., 1425 N. First Ave.
Nordon Die Casting Co., Inc., 30 N. Eighth Ave.

Melrose Park
Aallied Die Casting & Mfg. Co., Inc., 3108 W. North Ave.

Moline
Quad City Die Casting Co., 3800 River Dr.

Rockford
J. I. Case Co., Magneto Div., S. Independence Ave.
National Lock Co., 1902 Seventh St.
Precision Castings Co., Div. of Harsco Corp., 2025 Kishwaukee

Schiller Park
Delta Die Casting Corp., 9393 W. Seymour Ave.

Skokie
DuPage Die Casting & Fabricating Co., Inc., 8049 N. Ridgeway Ave.
Inland Die Casting Co., Inc., 8141 N. Lawndale

Winfield, Illinois
Hadlock & Temte, Inc., P. O. Box 405

Woodstock
Electric Auto-Lite Co., The Woodstock Div., 1st & Clay Sts.

INDIANA

Albany
Littler Diecast Corp., P. O. Box 351, State Rd. 67

Bedford
General Motors Corp., Fabricast Div., P. O. Box 271

Chesterton
Pressco Casting & Mfg. Corp., Broadway & Waverly Rd.

Evansville
Faultless Caster Corp., 1421 N. Garvin

Indianapolis
General Electroplating Co., 601 Russell Ave.

Kokomo
Turner Mfg. Co., Inc., 404 W. Superior

Logansport
Alpha Industries, Die Casting Div., 1300 Wheatland Ave.
S.U.S. Die Casting Co., Inc., 41 E. Market

Seymour
Paramount Die Casters, Inc., Freeman Field

Union City
Hardy Mfg. Corp., Sub. of Sheller Mfg. Corp.

Valparaiso
Indiana Steel Products Co., The

Waterloo
Kitchen-Quip, Inc., E. Marion Street

Winchester
Aluminum Die Cast Foundries, Inc.

IOWA

Dubuque
Ertl Co., The, 2475 Ertl Lane

Marshalltown
Bruin Mfg. Co., 607 N. Fourth Ave.
Kiowa Corp., 1200 E. May

Spirit Lake
Northern Iowa Die Casting Co., 1706 Ithaca Ave.

Webster City
Arrow-Acme Corp., 411 Prospect

KENTUCKY

Henderson
Tri-State Die Casting Corp., P. O. Box 337

MAINE

Lewiston
Peterson's Machine Shop, Russell St. Ext.

MARYLAND

Baltimore
Caldwell Casting Co., Inc., The, Falls & Shoemaker Rds.

Crisfield
Chas. D. Briddell, Inc.

MASSACHUSETTS

Boston
Page & Hall Mfg. Co., Inc., 1600 Hyde Park Ave.

Fall River
Webarm Diecasting, Inc., 71 Montaup

Hudson
New England Tool Corp., 53 Houghton

Hyde Park
L. E. Mason Co., 98 Business

New Bedford
Eastern Electric, Inc., 70 Prospect

Springfield
Hampden Brass & Aluminum Co., 262 Liberty

Worcester
Kennedy Die Castings Inc., 200 Harding

MICHIGAN

Bay City
Saginaw Bay Industries, Inc., 242 N. Water

Bangor
Du-Wel Metal Products, Inc., P. O. Box 307

Benton Harbor
Benton Harbor Malleable Industries, Inc., 171 Graham Ave.
New Products Corp., 448 North Shore
Soper Mfg. Co., 1099 Milton

Big Rapids
Denham Mfg. Co., Pere Marquette St.

Bridgman
Product Engineering & Mfg. Corp., Box 57

Centerline
Paramount Die Casting Products Co., 8313 E. Ten Mile Rd.

Clawson
Grand Steel & Mfg. Co., 1400 W. 14 Mile Rd.

Dearborn
Univex Die Cast & Engineering Co., 7001 Chase Rd.

Detroit
Accessories Mfg. Co., 5075 14th St.
Adjel Products Co., 13561 Helen Ave.
Continental Die Casting Corp., 9615 Grinnell Ave.
Dearborn Diecasting & Cavity Co., 199 Vinewood Ave.
Detroit Die Casting Corp., 597 Beaufait Ave.
Detroit Ice Machine Co., 2615 12th St.
Engineering Cast Products, 17601 Swift
Exact Tool & Die Co., 5829 Tireman Ave.
C. M. Hall Lamp Co., 1035 E. Hancock Ave.
Helm Accessories, Inc., 8820 Grinnell
Romada Tool & Mfg. Co., 9536 Dearborn Ave.
Lee Silver Service, Inc., 13561 Helen
Tann Corp., Congress Die Casting Div., 3750 E. Outer Dr.
Wolverine Die Cast Corp., 13700 Mt. Elliott

Dowagiac
Consolidated Die Cast Corporation of America

Eau Claire
Hermel Die Casting Corp., P. O. Box 141

Ferndale
General Die Casting Co., 1956 Burdette

Flat Rock
H & M Industries, Inc., 26810 Telegraph Rd.

Grand Rapids
American Die Casting Co., 850 Pannell St., N.W.
Brillcast, Inc., 2544 Thornwood, S.W.
Congdon Die Casting Co., 1266 Godfrey Ave., S. W.
Grand Rapids Brass Co., Div. of Crampton Mfg. Co., 420 50th St., S.W.
Grand Rapids Die Casting Co., 2125 Turner Rd., N.W.
Kent Castings Corp., 200 Garden St., S.E.
National Lead Co., Doehler-Jarvis Div., 525 Cottage Grove, S. E.
Nelson Metal Products, Inc., 510 32nd Street

Holland
Holland Die Casting Co., Inc., 582 Gordon

Jackson
Litemetal Dicast, Inc., 1927 Wildwood Ave.

Kalamazoo
Kalamazoo Die Casting Co., Mastenbrook Dr. & Milham Rd.

Madison Heights
Dynamic Die Casting Co., 510 W. Ten Mile Rd.

Marysville
Fort Die Casting Corp.

Melvindale
Atlantic Die Casting Co., 17740 Clarann

Midland
Dow Chemical Co., The, Magnesium Die Casting Sales

Muskegon
Buehrle Engineering Co., 856 E. Broadway

Ovid
Hyatt Die Casting Co., 428 Gratiot, Box 41

Petoskey
Petoskey Mfg. Co., 200 W. Lake

St. Joseph
Laboratory Equipment Corp., Hilltop Rd., P. O. Box 151
Paramount Die Casting Co., U. S. 12

Saline
Alumiloy Fabricators, Inc., 202 W. Bennett, P. O. Box 624
Hoover Ball & Bearing Co., Universal Die Casting Div., 232 Monroe

South Haven
Magnesium Industries, Inc., 1313 Kalamazoo

Three Rivers
Norwood Tool & Machine Co., 900 Wood

Van Dyke
Lincoln Die Casting, Inc., 20805 Mound Rd.

Willow Run
Monarch Governor Co., 2800 Tyler Rd.

Ypsilanti
Rutherford Bros. Plating Co., 7 Emerick (Plant), 318 E. Cross (Mailing Address)

MINNESOTA

Minneapolis
Blaking Co., 921 N. E. Main
Char-Lynn Co., 2843 26th Avenue, S.
Douglas Co., The, 620 12th Ave., S.
Strite-Anderson Mfg. Co., 1920 Washington Ave., S.
Twin City Die Castings Co., Talmage & 33rd Ave., S.E.

St. Paul
Lloyd Products, Inc., 1790 University Ave.
Sheldon Die Casting Co., 859 N. Prior Ave.

Winona
Lake Center Switch Co., 51 Johnson

MISSOURI

Buckner
Lyons Diecasting Co.

Kansas City
Rupert Diecasting Co., 1655 Cleveland Ave.

Monroe City
Monroe City Diecasting Co.

St. Charles
Sterling Aluminum Products, Inc., 2600 N. Third

St. Louis
Clyde Equipment Co., 3816 McDonald
Missouri Diecasting Co., 1411 N. 17
A. B. Mueller & Co., 2101 E. John Ave.
Republic Die Casting Co., 611 Talcott Ave.
St. Louis Diecasting Corp., 4528 Oleatha Ave.

NEBRASKA

Omaha
Morton Mfg. Co., 7025 Sarpy Ave.

NEW HAMPSHIRE

Nashua
Great American Plastics Co., Factory St.

NEW JERSEY

East Orange
C. M. Grey Mfg. Co., 358 Central Ave.

Elizabeth
Central Casting Co., 400-416 Trumbull

Garwood
Aluminum Company of America

Irvington
American Aluminum Casting Co., 332-334 Coit
Dollin Corp., 600 S. 21
Irvington Die Casting Co., 133 S. 20
Jersey Plastic & Die Casting Co., 149 Shaw Ave.

Kenilworth
Springfield Die Casting Co., Inc., 721 Lexington Ave.

Livingston
Stella Products Corp., 66 Okner Pkwy.

Millville
Wheaton Die Casting Corp.

Monmouth Junction
Pierson Machine Co., c/o Ridge Door Co.

Newark
Camp Aircraft Parts, Inc., 1133-39 McCarter Hwy.
Duane Specialties, Ltd., 209 Parkhurst
Art Jack Die Casters, Inc., 36 Goble
Micro-Products Engineering Co., 234-40 Ridgewood Ave.
Premier Die Casting Co., 28 Margaretta
Vacuum Die Casting Corp., The, Foot of Pacific St.

New Brunswick
Excel Products Co., Inc., Codwise Ave. & Elizabeth St.

North Bergen
Beaut Mfg. Co., Inc., 7500 Tonnelle Ave.

Nutley
Harbot Die Casting Corp., 52 E. Centre

Ridgefield
Diecasters, Inc.

Springfield
Haug Die Casting Corp., 52 Brown Ave.

Teterboro
Bendix Foundries

Trenton
Hooper Die Casting, 300 Maple Ave.

NEW YORK

Batavia
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Dieco Die Casting Corp., 59-27 Decatur
National Ornament Co., 6517 14th Ave.
Sterling Die Casting Co., Inc., 743 39th St.

Buffalo
Phoenix Die Casting Co., 21 Illinois

East Syracuse
Syracuse Die Casting & Mfg. Co., 2101 Teall Ave.

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Adept Castings, Inc., 39 Hanse Ave.

Hollis
Ideal Toy Corp., 184-10 Jamaica Ave.

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Long Island Die Casting, Inc., 21 Smith

Jamestown
Chautauqua Hardware Corp., 31 Water

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Falconer Metal Specialty Co., Inc., Winchester Rd.

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Criterion Toy & Specialty Co., Inc., 22-14 40th Ave.
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Master Fabricators, Inc., 6 Brooklyn Ave.

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Eastern Malleable Iron Co., Eastern Casting Corp. Div.
Hudson Valley Aluminum Co., Inc., Box 506

New Hyde Park, Long Island
Hamilton Die Casting Corp., Nassau Terminal, Jerico Turnpike
Monarch Tool & Machine Corp., 405 Second Ave.

New Rochelle
Gries Reproducer Corp., 140 Beechwood Ave.

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Gasket, Packing & Specialty Co., Inc., 3-5 Waverly Pl.
Mark Kenny Products Co., Inc., 251 E. 137
Metal-X-Specialties Co., Inc., 5 E. Third
Sherman Pressure Casting Corp., 601 W. 26

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Oswego Castings Corp., Box 222

Port Chester
Gorton & MacIntyre, 70 Traverse Ave.

Poughkeepsie
DeLaval Separator Co., 25 Columbia

Richmond Hill
Comet Metal Products Co., Inc., 91-00 132 Street

Rome
Geo. O. Schilling Bronze Co., 202-216 E. North

Syracuse
Precision Castings Co., Div. Harsco Corp., P. O. Drawer 1077

West Islip, Long Island
Seaboard Diecasting Corp., 1125 Prospect Ave.

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Allen-Stevens Corp., 33-53 62nd Street

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ZYX Die Casting Co.

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Dixie Die Casting Corp., Box 1208

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Manor Die Cast Corp., P. O. Box 386

Bedford Heights
Lester Castings, Inc., 25661 Cannon Rd.

Berea
Mohawk Die Casting Co., Sub. of Mohawk Foundries, Inc., 55 First

Canton
Frantz Mfg. Co., 1200 Camden Ave., S.W.

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Cincinnati Die Casting Co., The, 2117 Spring Grove Ave.
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Electric Auto-Lite Co., The, Lockland Div., Lockland P. O. Box 35
Varland Metal Service, Inc., 1350 Arlington

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Arrow Aluminum Castings Co., 3135 Berea Rd.

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Cleveland Hardware & Forging Co., The, Die Cast Division, 4518 Lakeside Ave.
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Laco Die Casting Co., 23440 Lakeland Blvd.
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Thompson Products, Inc., Light Metals Div., 2269 Ashland Rd.
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Columbus
Ohio Die Casting Corp., 266 E. Fifth Ave.

Conneaut
Conneaut Die Casting, 618 Sandusky

Cuyahoga Falls
Akron Presform Mold Co., The, 2038 Main

Dayton
Acme Die Casting Co., Inc., 746 Albany
Dayton Die Casting Co., 111 Front
Yoder Die Casting Corp., 727 Kiser

Euclid
Nelmor Mfg. Corp., 26420 Lakeland Blvd.

Ft. Recovery
Superba Die Castings, Box 147

Germantown
Atlas Die Casting Co., 362 N. Kelley Ave.

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Techni-Cast Corp., 600-608 Walnut

New Vienna
Wells Mfg. Co., Inc.

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Helfrich Die Casting Co., 208 Schneider Rd.
Hoover Co., The, Die Casting Div.

Toledo
Hilfinger Corp., 1800 Westwood Ave.
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Schultz Die Casting Co., 1810 Clinton

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Little Giant Vaporizer Co., Inc., 5101 Classen Blvd., Box 9545

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Ajax Die Casting & Mfg. Co., 2002 E. 6

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Kadee Metal Products Co., 720 S. Grape

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Future Products Co., 3625 N. Mississippi Ave.
Product Engineering Co., 4707 S. E. 17

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Parker White Metal Co., 2153 McKinley Ave.

Herminie
Auel Industries

Lancaster
Reese Padlock Co., 128 Sherman

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Latrobe Die Casting Co., Box 149

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Blue Ridge Pressure Castings, Inc., Bridge St.

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Hall-Wessel Co., 919-931 N. Fifth
La France Precision Casting Co., 29th & McKean Sts.
Super Grip Anchor Bolt Co., Inc., 3333 N. 22

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Continental Metallifacture Co., 414 Pine

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Roberts Engineering & Mfg. Co., Inc., 640 Navigation Blvd., Box 4060

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Madison-Kipp Corp., 213 Waubesa
Reuhl Products, Inc., 4505 W. Beltline Hwy.

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Streh Die Casting Co., Inc., 11123 W. Burleigh

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Acme Die Casting Corp., 1635 Murrary Ave.
Racine Die Casting Co., 1500 16th Street

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Banner Metal Products Ltd., 1680 Kildare Rd., Windsor, Ont.
Barber Die Casting Co., Ltd., Postal Station "B", Box 240, Hamilton, Ont.
Carpenter Die Casting Co. Ltd., 474 Burlington St., E., Hamilton, Ont.
Dominion Die Casting Ltd., Heinz St., Wallaceburg, Ont.
Gordon Mfg. Co. Ltd., 1390 Wallace, Wallaceburg, Ont.
Lakeshore Die Casting Ltd., 482 Queen Elizabeth Way, Oakville, Ont.
Mendler Mfg. Co., P. O. Box 125, Sandwich Postal Station, Windsor, Ont.
National Hardware Specialties Ltd., Box 250, Dresden, Ont.
Ontario Steel Products Co. Ltd., Die Casting Div., Chatham, Ont.
A. O. Pope Ltd., 90 Winter, Saint John, N. B.
Pressure Castings of Canada Ltd., 67 Main St., S., Weston, Toronto 15, Ont.
Richmond Machine Tool & Die Casting Co. Ltd., 165 St. Zotique St., W., Montreal, Que.
Schultz Die Casting Co. of Canada Ltd., Wallaceburg, Ont.
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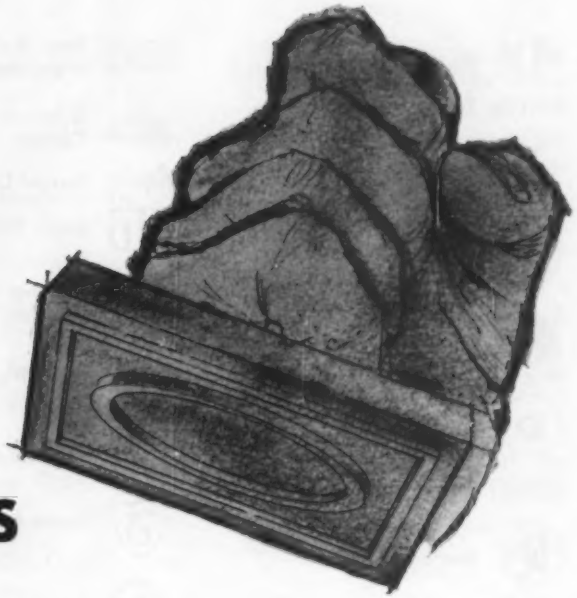

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Admiral Die Casting

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Elec. Auto-Lite Co., The Lockland Div.

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Future Products Co.

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Industrial Die Casting Co.

Irrigation Equipment Co. Industrial Div.

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Stewart-Warner Corp. Stewart Die Casting Div.

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Super Grip Anchor Bolt Co., Inc.

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Tann Corp. Congress Die Casting Div.

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Techni-Cast Corp.

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White Die Casting Co.

Yoder Die Casting Corp.

ZYX Die Casting Co.

Zenith Diecasting, Inc.

ABOUT THIS DIRECTORY . . .

This is the first published directory of jobbing die casters. Basis for all listings has been the information supplied by the individual die casters concerned. Only those die casters who returned PMM's questionnaire containing all the information, have been included, in the interests of complete authenticity.

Key to listings: Metals — (A) Aluminum (B) Copper-Base (C) Magnesium (D) Zinc (E) Lead (F) Tin; Facilities at the same address (1) Assembling (2) Die Making (3) Electroplating (4) Heat Treating (5) Machining (6) Painting.

A single asterisk after a company name indicates membership in the American Die Casting Institute. Double asterisks indicate a participant in the ADCI's Certified Zinc Alloy Plan.

Complete addresses for die casters are given in both the alphabetical and geographical listings, but additional data about these companies are included only in the alphabetical listing.

Bold faced listings indicate advertisers in this Directory Issue of PMM. For additional information about these companies, consult the Index of Advertisers beginning on page 145.

LABOR SHORTAGE

continued from page 51

and larger manufacturing quarters, these could not be available in time to allow consideration for this instrument.

The choice lay between a rough sand casting to be fully machined either in the present plant or by an outside shop; a precision casting made in the company foundry or a shell mold casting made either within or outside of the company.

Rough Sand Castings

The best accuracy that could be obtained on such parts made in an outside sand foundry was a tolerance of about ±1/32. This would have necessitated considerable machining for which no machine tools were available. While additional tools could be purchased, there was no room to set them or time to wait for them.

The necessary machining could have been done by an outside shop, but this had been found to be poor policy for parts requiring close work. Further, such a system brings with it inevitable disputes as to where the fault, if any, lay in the case of rejected parts. Rough sand castings seemed to be an extremely poor choice.

Precision Sand Castings

As noted before, there already existed within the company a foundry capable of making the parts as precision sand castings. All of the dimensional and surface requirements could be met by these castings. Again, the problem of space came up. With the load the foundry was carrying, it was impossible to take on additional work without increasing the number of molders and, along with them, the number of molding stations. While the new plant being planned would have adequate space, there was inadequate room at the time for more molding stations. A further limiting factor was the labor market.

During the past several years, the Denver area has seen a phenomenal industrial growth. As a result, skilled labor of all types is in extremely short supply. Even if the space were available for more stations, it is extremely doubtful if experienced molders could be found for the work.

Pattern making presented another serious problem. Patterns for this precision sand casting are far more difficult and expensive to make than for normal sand casting. Based upon the number of castings that would be required for this instrument, a plurality of patterns would have to have been made, each of which is expensive.

It seemed, therefore, that until more space became available and more skilled molders could be hired that precision sand casting could not be used.

Shell Mold Castings

The particular advantages of shell molded casting are accuracy, good surface finish and low cost over long runs. For the particular castings under discussion, it was clear that, if made in shell molds, the required dimensional accuracy could be achieved easily and a better than required surface smoothness would result. Further, when compared with precision sand casting, the tooling (patterns) would be less costly. As the castings would be produced, they could flow through manufacturing without the need of new machine tools or the employment of additional machine operators.

Continued on next page

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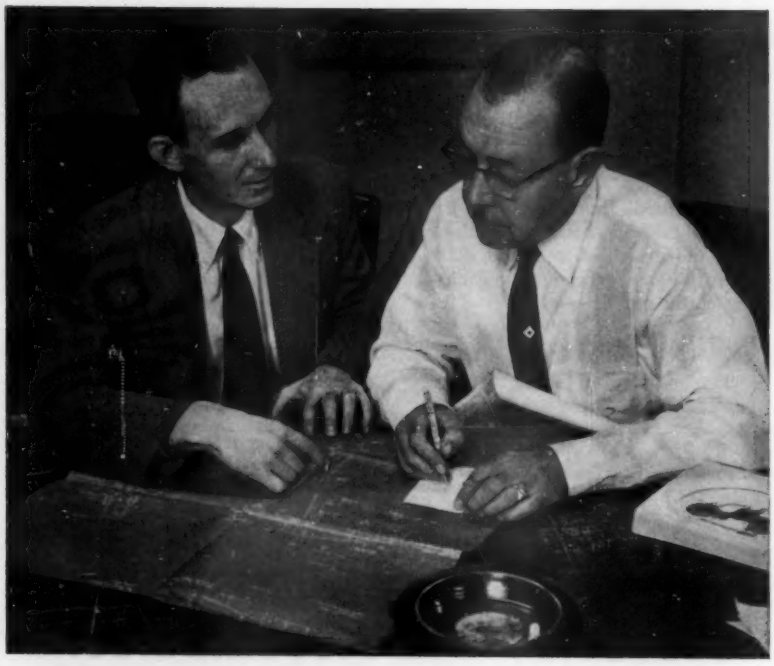

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CASE IN POINT!

Freedom of Design

The rudder over-balance eliminator used on the jet bomber is an investment casting of specification QQ-M-55 Magnesium, Alloy AZ-92. This intricate design is more economically produced by investment casting than any other process, permitting design freedom and assuring quality performance.

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A further advantage would be that almost totally unskilled operators could make the molds as against hiring highly skilled molders for sand casting.

Since the total floor space required for the manufacture of the shell molds was less than one additional molding stand, the problem of space ceased to be critical.

All of these considerations have led to the installation of equipment for making shell molds on a limited scale. The present speed of operation is about six times that of green sand molding for castings of comparable quality.

As a result of a careful analysis of possible manufacturing methods for these parts, they are now being produced in the quantities required at the lowest possible per piece cost without having to provide any additional manufacturing space and without having to make a relatively large capital investment in machine tools.

MOTOR FAN

continued from page 57

on this fan may seem excessive, the design has, up to now, been in a state of almost constant development. The design, as now finalized, will allow the use of a single casting on all sizes of motors up to and including 10 HP by simply turning the outside diameter to the required size.

The redesigned fan will, then, be a one piece casting with the shroud ring cast integrally with the fan. All mounting holes on the hub will be cored, as will the large hole in the hub. Except for adjusting to size for the particular motor on which the fan is to be used, the only machine work that will be needed will be to bring the hub bore to precise size and cut the keyway by reaming or boring and slotting operations.

The design that has evolved, cannot be die cast. The two possible methods of production are plaster mold casting and semi-permanent mold casting. Of these, plaster mold casting has been selected because of the lower tooling costs and smoother surface that can be achieved. Quite naturally, surface smoothness is important since the efficiency of the fan can be seriously lowered if the surface is too rough.

Polishing with 16" felt wheel is the final step in finishing Westinghouse electric fry pans. A photo story starts on page 101.

PMM

FINISHING SECTION

DEVOTED TO THE SPECIALIZED PROBLEMS OF FINISHING DIE CASTINGS, INVESTMENT CASTINGS, PERMANENT MOLD CASTINGS, PLASTER MOLD CASTINGS, PLASTER MOLD CASTINGS, POWDER METAL PARTS AND SHELL MOLD CASTINGS

The specialized finishing methods, equipment and materials used to machine, assemble, surface condition or surface coat precision metal molded parts are presented here. This includes all secondary operations which convert a raw casting to a finished product.

In this issue

99 Sixteen operations in nine seconds

101 How Westinghouse finishes electric fry pans

107 Buffed designs with stencils

(Advertisement)

Special Reports On Finishing Non-Ferrous Metals

NUMBER II—Paint Base, Corrosion-Resistant Finishing with Iridite

WHAT IS IRIDITE®?

Briefly, Iridite is the tradename for a specialized line of chromate conversion finishes. They are generally applied by dip, some by brush or spray, at or near room temperature, with automatic equipment or manual finishing facilities. During application, a chemical reaction occurs that produces a thin (.00002" max.) gel-like, complex chromate film of a non-porous nature on the surface of the metal. This film is an integral part of the metal itself, thus cannot flake, chip or peel. No special equipment, exhaust systems or specially trained personnel are required.

Chromate conversion coatings are well known and accepted throughout industry as an economical means of providing corrosion protection, a good paint base and decorative finishes for non-ferrous metals. However, continued developments have been so rapid and widespread that many manufacturers may not be completely aware of the breadth of application of this type of finish. Hence, this digest of current information; to bring you up to date on the many ways in which you can obtain proper surface preparation for painting and increase product durability with a single multi-purpose chemical pretreatment. Report I on decorative, corrosion-resistant finishes and Report III on chemically polished, corrosion-resistant finishes are available on request.

First, it is an accepted fact that metal surfaces should be prepared before painting to make possible an efficient paint system. Naturally, this preparation should provide for good initial paint adhesion. Chemical treatments have proved extremely effective in this respect, particularly those of a neutral or preferably acid nature. Further, to be most efficient, chemical treatments should provide a non-porous barrier to maintain adhesion by sealing the metal from the paint and moisture. They should also provide a self-healing film which prevents lateral corrosion in the event that bare metal is exposed through scratching.

The Iridite chromate conversion coatings meet all these requirements. Iridite is a chemical conversion treatment for surface preparation. It provides initial paint bonding by molecular adhesion. It is acid in nature and produces a film that is gel-like and non-porous in structure. Thus, the Iridite film effectively seals the metal from the paint and from moisture penetration. Because the film contains certain relatively soluble constituents, it will protect areas scratched through to bare metal and prevent lateral corrosion. This is accomplished by a gradual leaching of these constituents into the damaged area.

Further, because of its gel-like, non-crystalline nature, the Iridite film will not affect the appearance or texture of the paint film, nor will it dust or powder to mar the painted surface. Because the film is non-porous, paint coverage is increased, thus substantial savings in paint costs will be realized. In addition, treated parts may be stored for long periods of time prior to painting without the risk of entrapped moisture causing blistering when painting.

Iridite chromate conversion coatings are widely used with equal ease and success under both baked and air-dried paint systems. While the actual adherence properties of the Iridite film do not increase appreciably with its thickness, corrosion protection does. The protection of the Iridite film is proportionate to its thickness and should be taken into consideration when selecting the Iridite to meet your needs. However, it is sometimes necessary to sacrifice maximum corrosion protection for appearance when a finished part is to be only partially painted. For example, it may be desirable to use a thin, clear, bright Iridite film if the unpainted areas must present a chrome-like appearance. A typical case is that of instrument housings on which the exterior is painted and the inside left unpainted.

On the other hand, if all surfaces of the product are to be painted and maximum corrosion protection is required, the heavier and most protective Iridite films should be used. For example, all surfaces of zinc die cast fruit juicers are finished with a highly protective Iridite film prior to painting to provide maximum resistance to the corrosive action of fruit juices.

Iridite finishes are now available for all commercial forms of the more commonly used non-ferrous metals, including zinc, cadmium, aluminum, magnesium, silver, copper, brass and bronze. In addition to providing an excellent base for paint, the Iridite films also have high decorative value when used as final finishes in themselves.

These films can produce a wide variety of pleasing appearances including clear bright, iridescent yellow, bronze, olive drab and brown. In addition, many films can be modified by bleaching or by dyeing. Among the dye colors available are various shades of red, yellow, green, blue or black.

In planning or designing, you should consider the many other characteristics of Iridite finishes which may enter into the specific problem. In addition to their functions as protective and decorative finishes, and as bases for organic finishes and bonding compounds, Iridites have low electrical resistance. Some can be soldered and welded. The film does not affect the dimensional stability of close tolerance parts.

Iridites are widely approved under both Armed Services and industrial specifications because of performance, low cost and savings of materials and equipment.

You can see then, that with the many factors to be considered, selection of the Iridite best suited to your product requires the services of a specialist. That's why Allied maintains a staff of competent Field Engineers—to help you select the Iridite to make your installation most efficient in improving the quality of your product. You'll find your Allied Field Engineer listed under "Plating Supplies" in your classified telephone book. Or, write direct and tell us your problem. Complete literature and data, as well as sample part processing, is available. Allied Research Products, Inc., 4004-06 East Monument Street, Baltimore 5, Maryland.

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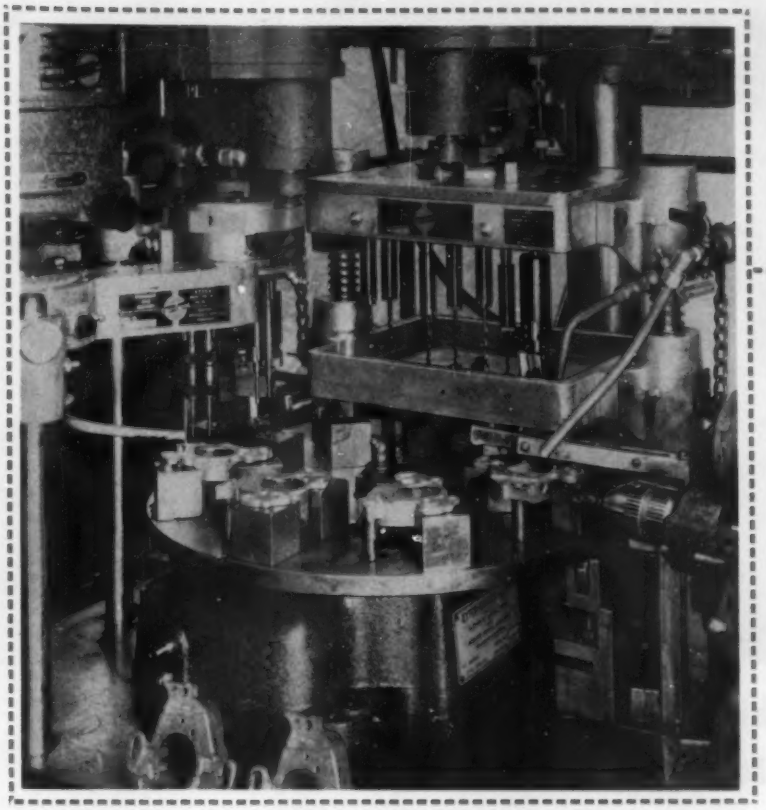
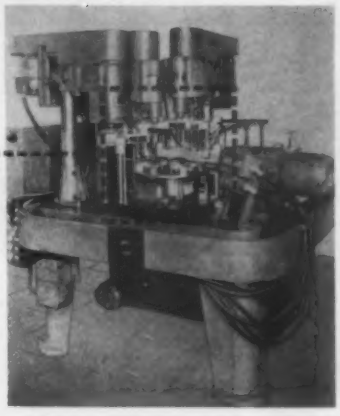




STANDARD DRILL UNITS coordinated with electrical controls, speed up the drilling and tapping of small holes.

Automatic machining setup for small holes performs

Sixteen Operations In Nine Seconds

CYCLING DATA

Station #1: Load and unload part.

Station #2: Horizontal D.U.#2 Drill Unit — Drill .316 dia hole in side of part.

Station #3: 7-Spindle multiple head attached to D.U.#2 Drill Unit — Drill (1) .158 hole in top of part; drill (1) .173 hole in top of part.

Station #4: Drill (1) .136 hole; Drill (2) .128 holes; Drill (1) .109 hole.

Station #5: Ream (1) 1.375 hole.

Station #6: 5-Spindle multiple head attached to D.U.#2 Drill Unit — Deburr on both sides of part.
Deburr (2) .131 holes
Deburr (1) .158 hole
Deburr (1) .136 hole

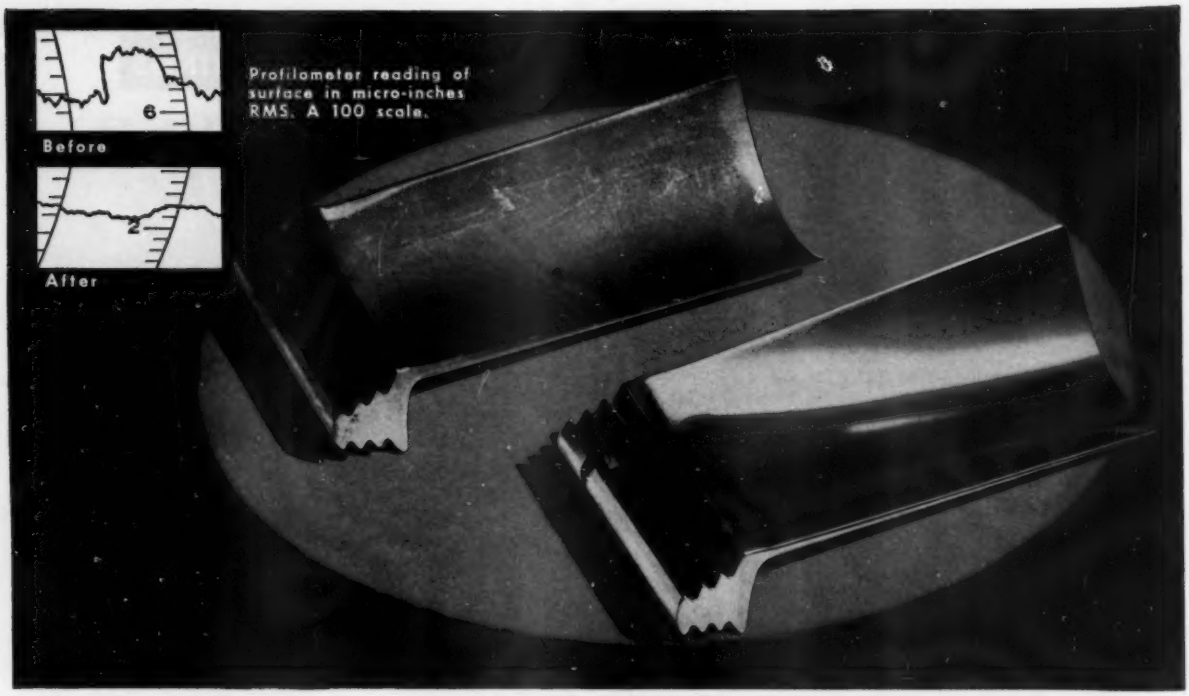
Station #7: 2-Spindle multiple head attached to ATU#3 Lead Screw Unit.
Tap (1) #6-32 hole.
Tap (1) #8-32 hole.

Station #8: Open

EVERY nine seconds, all at one time, ten holes are drilled, four deburred and two are tapped in an aluminum alloy (P-7083) die casting on the special 4-way drilling and tapping machine shown above.

The part is a plate-cast stator for the magneto of a small gasoline motor. In order to meet customer's production requirements of 400 completed pieces per hour, Ettco Tool & Machine Co., Inc., developed this multiple drilling and tapping machine which consists basically of two of the company's standard vertical drill units, one vertical automatic lead

Continued on page 106



Cut parts finishing costs, maintain exact tolerances, get absolute uniformity with *Roto-Finish* processes

Roto-Finish, pioneers in precision barrel finishing, offer you a complete finishing service. Savings on deburring, descaling, grinding, polishing, coloring and surface improvement are tremendous. Expensive hand finishing methods can be eliminated.

Roto-Finish processes are controlled to produce the finish you need with no significant dimensional changes. You get absolute uniformity of finish in quantity lots.

Many prominent manufacturers now using Roto-Finish processes are saving money on finishing costs. (Names on request).

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There is no costly trial and error involved in the purchase of Roto-Finish equipment. You submit unfinished parts to Roto-Finish along with a finished sample and a description of the finish you require. These sample parts are processed in the Roto-Finish Sample Processing Laboratories, where experienced engineers determine the combination of chips, compounds, and machine required to do the job. Roto-Finish guarantees to reproduce the same results in your plant, using the Roto-Finish processes, that are achieved in sample processing. This service demonstrates for you exactly what you can gain by using Roto-Finish processes.

The sample processing service is available to help you with your finishing problem. Take advantage of this opportunity to save on finishing costs. Send samples of finished and unfinished parts and details of the type of finishing equipment available in your plant.

SEND FOR THIS FREE TECHNICAL DATA FOLDER

It describes the basic process, chips and compounds and the complete Roto-Finish line of standard and special machines.

Roto-Finish COMPANY

3716 Milham Road, Kalamazoo, Mich.

P. O. Box 988

Phone: FI 3-5578

FOREIGN REPRESENTATIVES:

AUSTRALIA — A. Flavell Ltd. — 89 Tulip Street — Cheltenham.
BRAZIL—Commercial E. Industrial de Fornos Werco, Ltda.—rua General Gurjao, 326—Rio de Janeiro.
CANADA—Canadian Hanson & Van Winkle Co., Ltd.—Cor. Silver and Morrow Avenues—Toronto.
ENGLAND — Roto - Finish Limited — Mark Road, Hemel Hempstead — Hertfordshire.
FRANCE — Societe Roto - Finish — 40-42 rue Chance Milly — Clichy (Seine) — Paris.
GERMANY, AUSTRIA, NORWAY, SWEDEN, SWITZERLAND — Metallgesellschaft A. G. — Reuterweg 14 — Frankfurt a. M. — Germany.
HOLLAND, BELGIUM, LUXEMBURG — N. V. Roto-Finish Maatschappij — Rotterdamseweg 370 A. Delft, Holland.
ITALY — Societa Roto - Finish a R. L. — Sesto S. Giovanni — Viale E. Marelli, 31 — Milan.
SPAIN — Instituto Electroquimico, S. A. — Corcega 58 — Barcelona.

For more information circle No. 118 on the Reader Service Card

ELECTRICALLY HEATED fry-pans start at this book type mold, made of Meehanite. It carries a swinging block to hold and position the combined heating element and thermostat tube. The gates and risers for this mold are clearly indicated as is the top venting. A single pour requires six lbs. of 43S Aluminum, poured at 1500 F. Two molds can produce 400 castings per shift. Normally, the foundry operates two shifts per day; this keeps the finishing line operating one shift per day.

STARTING SURFACE FOR FINISHING, as developed by permanent mold casting, is illustrated by the top and bottom views of the castings as they come from the mold. The clean cut off of metal on the inside edge of the pan and the very slight chill and ejection marks are notable. The high fluidity and good cooling characteristics of the alloy used make possible the casting of such a thin walled part. Two small holes (arrows) in the portion of the casting that houses the heating element are closed by heli-arc welding using bare 43S rod. These holes are from the positioning pins used to hold the heating element during casting.

How Westinghouse Finishes Electric Fry-Pans

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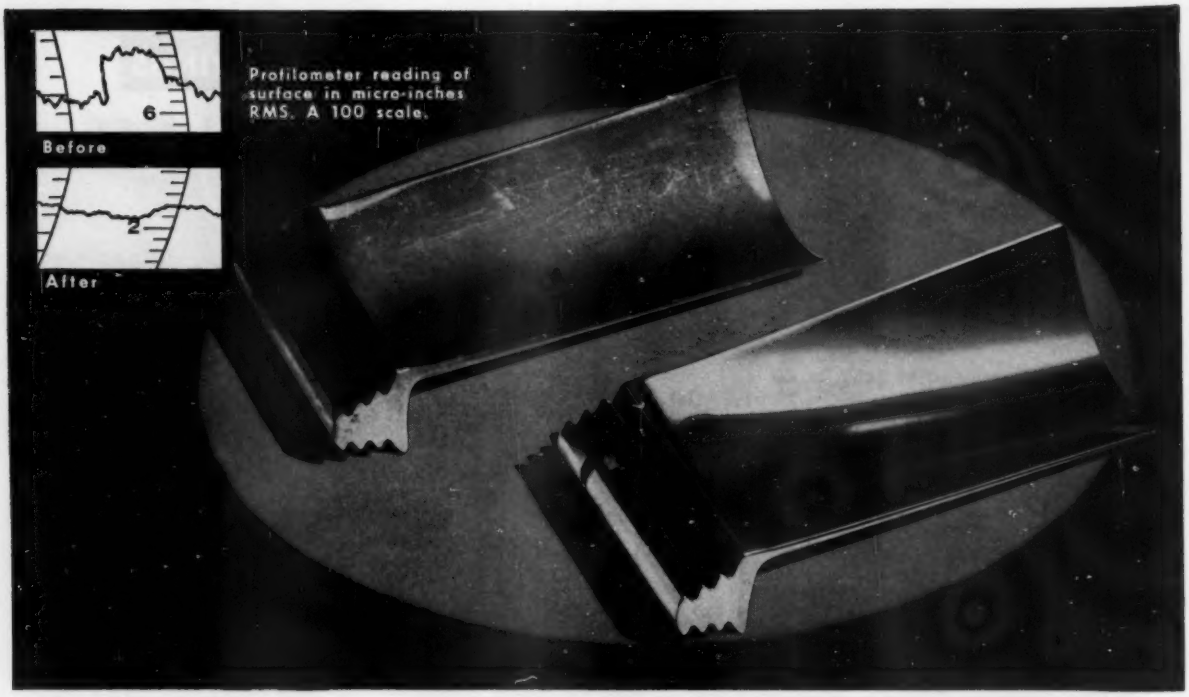
The pan castings are produced in two single cavity molds, handled by a single operator.

THE TEN STEPS FROM RAW CASTING TO FINISHED PIECE



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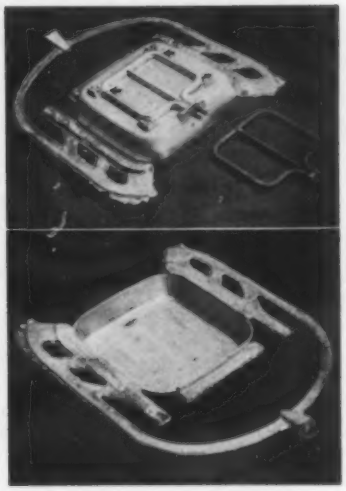

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The pan castings are produced in two single cavity molds, handled by a single operator.

THE TEN STEPS FROM RAW CASTING TO FINISHED PIECE

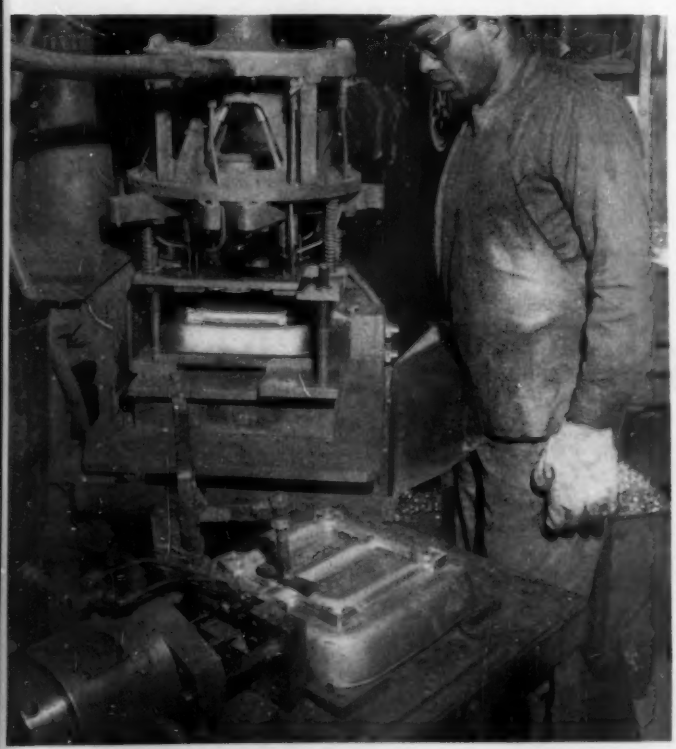
The finishing of a casting properly starts with the preparation of the gated part for all subsequent operations. In the case of the fry-pan, it was known at the start that several automatic or semi-automatic operations would be involved and that these would require chucking in some cases by supporting the pan on the cast feet and in others by vacuum chucks holding against the inside bottom.

It followed then that the feet and bottom would require precise flattening as first steps. Following these steps, which also include trimming to remove gates, risers and flash, all drilling and tapping is done and the pans then move onto the orthodox surface finishing line. Here the different stages of sanding, first with a relatively coarse abrasive and finally with a very find abrasive are done.

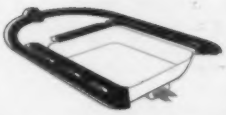
Naturally, any finishing operation must follow a prescribed sequence involving smooth flow of materials with minimum handling from station to station. While the casting is still warm, bottom flattening is best done, so starting at this first stage, the sequence for finishing these pans is illustrated here.

AIR POWERED PRESS is used to flatten the bottom of the pan and cool it at the same time. Subsequent operations will not cause warpage and this step insures there will be neither a hump nor hollow in the finished pan.

BOTH THE LEGS of the pan and the end where the handles will fasten on must be drilled and tapped. The eight holes in the feet are gang drilled and tapped using a standard Commander multiple spindle drill head. Two holes for the handle are drilled and tapped in a special air operated-Zagar unit designed particularly for this operation. All holes are blind so that length of stroke in both drill units must be precisely controlled.



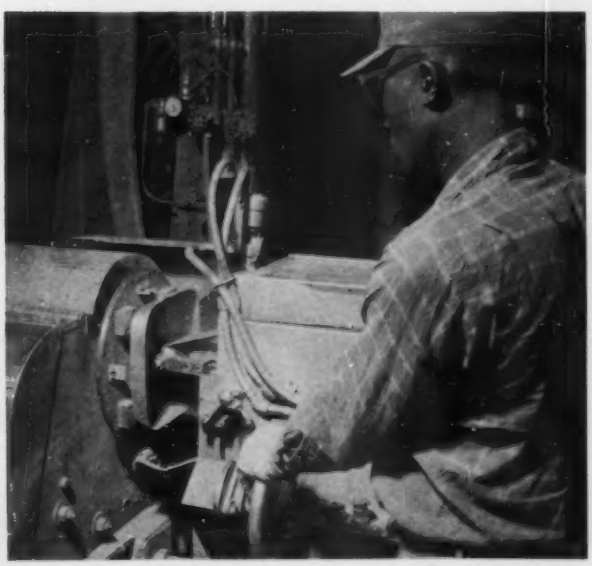
FIRST TWO STEPS in the surface finishing of the fry-pans are shown. At the left a belt grinder co-operating with an automatic positioner surface sands three sides of the pan. The positioner utilizes vacuum chucking and is cam operated to maintain the pan in fixed relation to the abrasive belt. On the right an operator is hand sanding the fourth side. This side carried the heating element outlet and is not amenable to automatic operation.



WITH THE CASTING firmly supported and positioned, all gates, runners, risers, etc. are trimmed off. A cam operated, single stroke press is used for this operation. In back of the operator one of the pans can be seen in position to have the cast legs milled to length. This step insures that the finished appliance will sit evenly on any flat surface.

TRIMMING THE TOP edge of the pan removes vestigial flash and any burrs resulting from trimming. The importance of the previous step of milling the feet to exact length is shown here since the pan is positioned on a flat table under the wheel. With the trimming wheel set exactly parallel to the table, a uniform height of pan edge is assured.

FIRST GRIND on the inside of the pan is being done. The pan is positioned on the cast feet on a rotating face plate. By moving the idler pulley over which the abrasive belt runs in both a vertical and a horizontal direction, the entire inside bottom of the pan is sanded. The radius of the idler is correct to match the radius of the pan. The belt used here is 100 grit. The work is done under a fuel oil lubricant at 6000 sfm.



BLENDING-IN the bottom radius is done before sanding the sides. This abrasive belt machine utilizes a contact wheel of the same radius as the curve between the bottom and sides of the pan. All curves can be sanded in here by having a relatively narrow belt in a fixed position and moving the pan on a cam operated rotating table. The abrasive belt used in this step is also a 120 grit running with Tallowene lubricant at 4700 sfm.

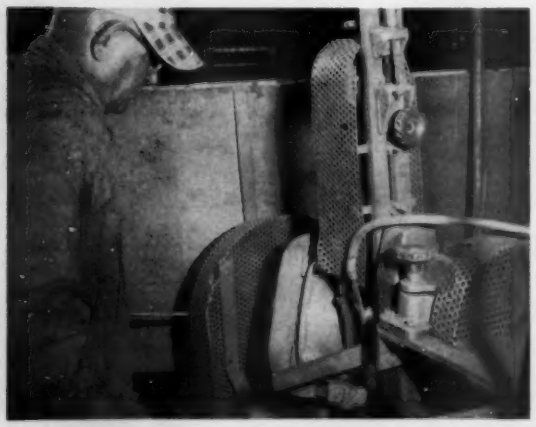
ON COOKING UTENSILS

FINISHING IS A PRECISION OPERATION

FINAL POLISHING of the fry-pans is done here, using both abrasive belts and felt bobs. Where abrasive cloth is used it is, for the most part, stationary and the pan moves. This is seen most clearly where the operator on the extreme right is polishing the bottom of a pan. The final polishing and coloring requires the use of a lubricant and a stick material composed of tallow and oil (Tallowene) is used. This same lubricant is used on the felt bobs employed in finishing the inside corners and sides in the left foreground.

SANDING of the inside corners is done with an abrasive belt and with the pan mounted on a holding fixture that positions the edge in a horizontal plane. This step blends the corners into the sides. At this stage the only un-sanded portion of the pan is the small bottom sections at and in front of the corners.

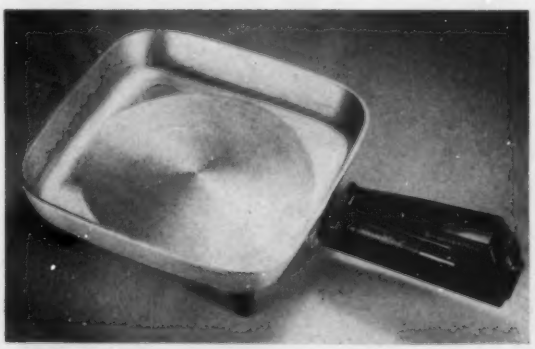
The unsanded portion, resulting from rotating the pan for bottom sanding can be seen. As before the same grit belt and lubricant are used so that the finish is uniform.



LAST STEP in the finishing operation is a touch up. Using a moderately hard felt wheel 16" in diameter, all four sides of the pan are polished on the cam operated fixture in the background. The final touch-up and blending is done, when necessary, by hand. For this, tripoli polishing compound is used.

LOOKING THEM OVER, J. T. Drylie, superintendent of foundry (left) and Paul Ziman, general foreman, inspect a few of the 800 fry-pans made per day at the Westinghouse Electric Corp.'s Cleveland works.

READY FOR FRYING, this Westinghouse electric fry-pan has passed through complete finishing and assembly. Flatness, uniformity, good surface finish and soundness of castings all contribute to the effectiveness of this modern kitchen device.



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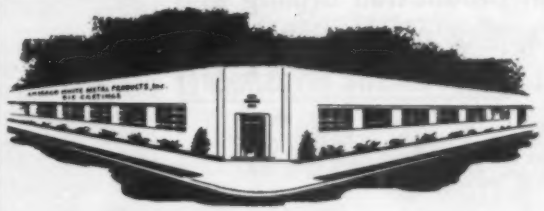

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Pangborn has redesigned the Hydro-Finish for added efficiency and easier handling. *Originating the use of air jet sluriators to eliminate pumps,* the new Hydro-Finish represents a lower investment as well as a lower maintenance cost. Optional equipment simplifies overall operation. Investigate Pangborn Hydro-Finish now!

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Pangborn

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Let ETTCO help you plan on production drilling and tapping of small holes ... *at a realistic investment!*

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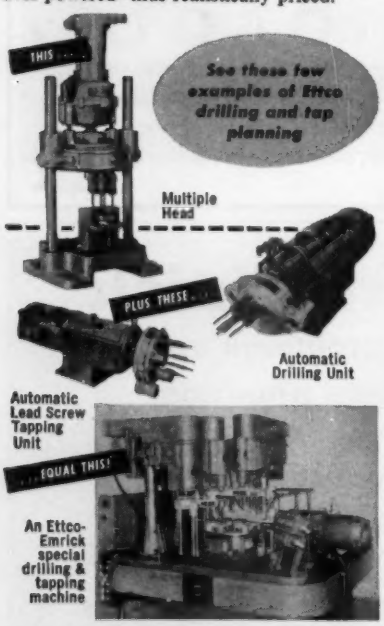
Ettco-Emrick equipment is built of standardized "Unit-Engineered" parts and *fewer* parts—most of which are interchangeable and reuseable elsewhere.

And since Ettco concentrates solely on the design and manufacture of small hole equipment, you can be sure the unit or machine recommended is *exactly* suited to the job; highly efficient, yet never expensively over-powered—thus realistically priced.


THIS ...
See these few examples of Ettco drilling and tap planning
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PLUS THESE ...
Automatic Drilling Unit
Automatic Lead Screw Tapping Unit
... EQUAL THIS!
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SIXTEEN OPERATIONS

continued from page 99

screw tapping unit and one horizontal drill unit.

These assemblies are mounted on a standard cast iron machine base with built-in coolant tank and pump. Electrical controls and wiring conform to J.I.C. standards. Tooling for the part consists of an 8-station Ettco-Emrick index table with eight nests to receive the part.

Operation of this special machine is simple. The operator unloads one part and reloads another in the load station over two locating pins. He then presses a button which sends an electrical impulse to the index fixture. This indexes the loaded part to the work stations and also through a limit switch within the index, actuating the four units simultaneously to perform the necessary drilling, reaming, deburring and tapping operations.

After the machining cycle has run its course to produce one completed part, all units automatically return to start position and the cycle is repeated.

Machines such as this with more or less elaboration can be adapted for any small hole operations.

MAGNESIUM DIE CASTING IS MEETING TOPIC

The January 15 meeting of the Cleveland chapter, Society of Die Casting Engineers, will be addressed by F. C. Bennett, chief of the die casting section, Metallurgical Laboratories of the Dow Chemical Co. Mr. Bennett will speak on "Techniques for Die Casting Magnesium."

As the recipient of the Willard H. Dow memorial award last August, Bennett was cited for his contributions toward the advancement of magnesium die casting techniques. He contributed to the development of hot chamber magnesium die casting and has done research work on the thermal reduction of magnesium and other metals.

Mr. Bennett holds a bachelor of science degree from the University of Illinois and a master of science degree from California Institute of Technology.

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DIE CASTINGS

DECORATIVE EMBLEMS ARE USUALLY APPLIED BY ONE OF THESE METHODS

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- **Paint-spraying with electroformed masks**
- **Paint filling of depressed surfaces**
- **Rolling of raised surfaces**
- **Silk screen printing**
- **Selected abrasive blasting**

AFTER BUFFING, bright sheen of letters will contrast with satin finish.

Now A New Self-Sticking Tape Permits . . .

Buffed Designs With Stencils

AMONG the techniques available for finishing and decorating die castings and other metal products, a recent development utilizing die-cut pressure-sensitive tape stencils can produce high quality inscriptions and designs on metal surfaces—without expensive hand engraving or machining.

The technique involves the following steps. After the surface of the piece is cleaned and polished in the design area, the tape is applied and rolled on with a squeegee to insure adhesion around the edges. The piece is then buffed to a satin surface using a slow-rotated cloth wheel with an abrasive compound.

When the tape is removed, the letters or design have a bright surface in contrast to the satin finish of the rest of the piece. Cleaning and lacquering is the final step.

Decorative stencils can also be used to put a buffed design on a highly-polished surface, eliminating an expensive stamping operation and the cost of metal dies.

A thin paper-backed tape was developed by the Gleicher Manufacturing Corp. for the Herman J. Wolf Co., a Philadelphia manufacturer of religious articles. The tape was not only strong enough to withstand the abrasive action of the buffing wheel, but was low in cost and thin enough to give sharp lines and clear design details. Wolf reported savings of more than 500 percent plus a fine quality finish with the process.

Two problems lead to the development of the tape used by Wolf. Cloth-backed tape, with good tear resistance to withstand the abrasive action of the buffing wheel, would normally be suitable. But the thicker cloth stencil would not give the fine lines needed for the job, and the use of cloth tape would have been too expensive.

Tapes backed with paper, cloth, synthetic films, and laminates of more than one material offer a multitude of properties to fit a wide variety of specific uses. On any product that might be "dressed up" with designs on large plain surfaces, the use of tape stencils may provide an effective, low-cost method.

NOW...
a Skimmer that really SKIMS! from Spincraft

Skimmers and Ladles available in STAINLESS STEEL and MILD STEEL

In answer to continued requests from hundreds of its ladle customers, Spincraft has added a line of truly superior skimmers. Designed after extensive research, Spincraft Skimmers meet die casters' skimming requirements. The shallow radius "skims" instead of "ladles" as deep-cupped skimmers do. Correct size perforations prevent clogging. Handle stub fits common pipe—attach a handle of exactly the type and length you want. Diameters: 6", 8", 10" and 12".

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Light, tough, long-lasting — designed to reduce operator fatigue, minimize spillage and improve heat transfer. In 23 sizes, from ¼ lb. to 30 lbs.—with or without handles. A die-casting *must*.

Write for complete data and prices on ladles *and* skimmers TODAY.

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ENGINEERED CASTINGS SHOW SCHEDULED MAY 6-10 WITH AFS CASTINGS CONGRESS IN CINCINNATI

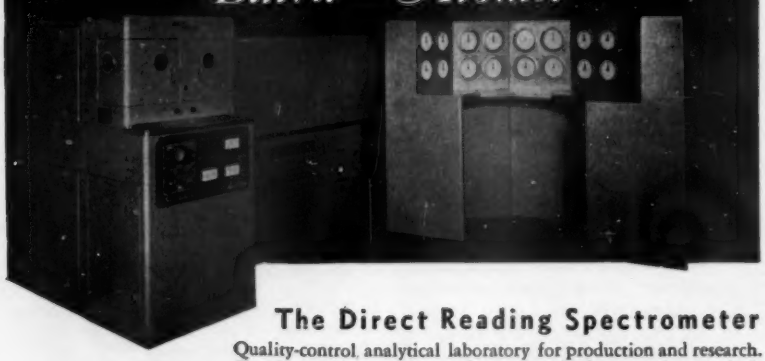
Announcement of the Engineered Castings Show is expected to expand the use of cast products both as component parts and end products in all fields of manufacture, according to the American Foundrymen's Society, the show's sponsor.

The five-day event will be held in conjunction with the 61st AFS Castings Congress at the Cincinnati Music Hall May 6-10. Scheduled are technical sessions pointed toward the interests of both product design engineers and users of cast products.

Show exhibits are limited to four catagories: companies producing metal castings for sale; manufacturers of laboratory equipment for testing and quality control; producers of metals and alloys contributing to castings quality; and companies producing patterns for sale.

By launching this show, the AFS announced that it wants to make it possible for castings producers to demonstrate that castings are "the shortest distance between raw material and finished product."

SPECTROGRAPHIC EQUIPMENT for Metal Analysis by Baird — Atomic



Baird-Atomic offers a complete line of spectrographic equipment for the analysis of metals in production and fabrication.

B-A instruments provide rapid, accurate analysis . . . simple, stable operation, trouble-free economical performance.

The Direct Reading Spectrometer

Quality-control analytical laboratory for production and research. Simple, rapid operation — forty seconds for complete analysis on dials reading directly in percent concentration. Permanent optical alignment with the Automatic Servo Monitor. Other features include: unique (patented) measuring system . . . plug-in components assuring continuous operation . . . rugged design for plant operation . . . and versatile specimen holders.

Spectromet Designed for production-floor operation by non-technical personnel. Sealed housing provides complete environmental protection of optical and electronic systems. Spectromet provides rapid direct-reading results, extremely simple operation. No critical adjustments. Automatic Servo Monitor for permanent optical alignment. Analysis of eight elements in 40 seconds.

Complete Spectrographic Laboratory

Baird - Atomic, a pioneer in the emission spectrographic instrument industry, offers a complete line of equipment for a spectrographic laboratory. Over twenty years of experience and design are incorporated into the following components: Three-Meter Grating Spectrograph, with its 20-inch camera; Double Beam Densitometer Comparator, employing an optical null-balance system and allowing for direct density measurements on a linear scale; Calculating Board, to easily translate densitometer readings into percent concentration values; and Spectrographic Source Unit, whose versatility supplies a full choice of excitation conditions for all emission problems.

Complete Technical Information Available Upon Request.

BAIRD ATOMIC

Baird — Atomic, Inc.

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PRESSURE TIGHT

continued from page 53

gy of four times (as contrasted with a doubling in energy when mass is doubled), it becomes more practical to try to accomplish the desired end by a velocity increase.

Prior attempts to accomplish the desired end have resulted in a squeezing action that has always been slow enough so that a major degree of solidification had taken place before any appreciable increase in pressure was achieved. Such action always gives a time-pressure curve as shown in Figure 3. Thus, by the time the pressure is built up, no free movement of the metal is possible. While some increase in density is possible by this procedure, there is no decrease in the amount of entrapped air; the pores are made smaller and the air in them compressed.

If instead of the squeezing action described above, the second application of pressure is at very high velocity, the effect will be that of an impact. By providing this impact while the metal is still liquid, or largely liquid, such densification as takes place can be entirely at the expense of air expelled from the pores.

But even if the second application of pressure is as an impact, there is another factor which can make such a scheme fail: this is the compressibility of liquids.

There is a popular misconception that all liquids are completely incompressible. Actually, all liquids are compressible to some extent and this varies considerably from liquid to liquid. It also varies considerably with pressure. This compression is sufficient so that some liquids are now used as springs, notably certain of the silicones. While comparative data are lacking, commonly used hydraulic oils at a pressure of 1000 psi will compress about ¼ inch in a six foot column. It follows, therefore, that to make an impact system work, an hydraulic fluid with a very low coefficient of compressibility must be used in the system.

It is quite obvious from the above why a relatively slow build up of pressure after initial injection has always failed to give the desired results.

If, instead of a relatively slow application of pressure in the sec-

ond injection stage there is a sudden increase, as indicated in Figure 4, and, if this second stage takes place in a system that has the lowest compression factor and before the liquid metal has solidified, additional liquid metal can be forced into the die cavity at the expense of entrapped air.

What has been given above might well be classed as only theoretical considerations. How do actual castings compare when made under as near identical conditions as possible, except for the second injection stage? A direct comparison is shown in Table I.

TABLE I. Castings Compared

Property	Normally Cast	Impact Cast
Density		up 10%
Porosity		down 10%
Rejects	10%	½% max.
Costs		up 2% max.
Inspection	100%	25% max.

Along with the decreased porosity and increased density comes an increase in tensile strength. The amount of this increase is not definitely known, but it is great enough for the regulator parts that are made by the process to carry a minimum yield strength in tension of 27,000 psi for alloy 380.

It could be reasonably expected that fatigue strength and all mechanical and physical properties that are associated with both metal density and notch sensitivity would also be improved. Such properties would include both thermal and electrical conductivity, creep resistance, strength in torsion and yield in compression.

While most, or all, of the alloys normally die cast can be cast by impact injection and all will show some improvement, alloy 380 is preferred because of its much wider temperature range between solid and liquid. This is clearly illustrated by the phase diagrams. It should be noted that some change in die design may be necessary to take full advantage of this process, but this does not cause any appreciable difference in die costs or die life.

Where Powers Reguires Dense Castings

In the 8" Powerstroke, both the upper and lower housing members shown in Figure 6 represent conversions from grey iron castings. When the change was contemplated, the question of strength naturally arose. Both of these castings are reasonably highly stressed in service. The redesigned parts were, therefore, made as sand castings, using the same alloy as was contemplated for the die castings.

These sand castings were then stress-coated and tested. As a result of these tests, it was evident that gussets and stiffening ribs would have to be put in where their need had not previously been anticipated. With the addition of the strengthening members that the tests called for, the die castings were made and again stress-coated. These castings, under test, showed no unduly high stress concentrations.

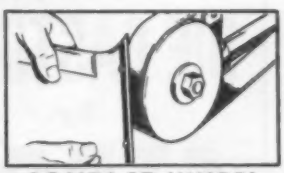
Little finish machining remains to be done on these castings after delivery from the vendor. A few holes must be drilled and tapped, using jigs and one hole reamed. Also, the air inlet in the upper housing must be counter-bored and tapped for ⅛" pipe thread. Dimensionally, these castings are well within normal shop tolerances. In all but two cases these dimensional tolerances need only be ±0.008; the two exceptions are a tolerance of ±0.003 on about 2.5" and ±0.005 on a 7.2" diameter bolt hole circle.

Earlier, mention was made that one part of this Powerstroke assembly was retained as cast iron because mechanical data on die castings were lacking. In Figure 1, the arrow indicates a cast iron

Hammond of KALAMAZOO

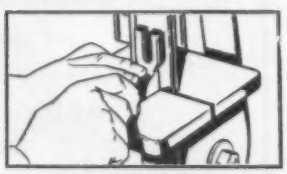
FOR DEBURRING ECONOMY

Model 50-DD



CONTACT WHEEL

IRREGULAR SHAPES



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connecting link between the lower housing and the valve body. It is known that this part is subject to considerable fatigue stress over long periods of time.

No data on the long time fatigue strength of aluminum die castings are known to be available that would give some indication of how a die cast part might hold up in this service. However, years of experience have shown that a grey iron sand casting does this job adequately — the part has, therefore, been retained as a sand casting in iron.

To surface finish these parts, they are cleaned, degreased, prime coated, spray painted with a heavy bodied red enamel and finally baked.

Through the use of die castings, there has been a saving in this 8" motor of nearly 50 percent in manufacturing costs. Important though this dollar saving is, it is secondary to the fact that with the growth of the company, *it would be necessary to have at least three times the machine shop facilities and three times the number of machine operators* presently employed if it were not for the use of many die castings.

It is always difficult to set any sort of a figure as to when it becomes most economical to use die castings in preference to some other method of fabrication. Naturally, much of the answer will depend upon the complexity of the tooling required, the kind and amount of machine work saved, whether any capital investment can be saved and/or additional personnel hired.

Considering all of these factors, it has been found by this company that when any unit that has die castable components is made in quantities of 2500 or more per year, then die casting will probably be economical. This applies, of course, to both older equipment now being made and new products where the annual sales can be predicted with some accuracy.

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INQUIRIES INVITED!

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11123 W. Burleigh St., Milwaukee 10, Wisconsin

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PATENTS

continued from page 41

A METHOD OF PRODUCING IRON POWDER directly from ore that is substantially pure iron oxide. The ore is mixed with ash-free coke and a binder, molded into briquettes having a cross section thickness of less than 2 inches and the briquettes are then heated at a temperature of from 1900 to 2050 F in a reducing atmosphere for from 20 minutes to 5 hours, depending upon the temperature of reduction and the gas composition. From 5 to 10 percent excess coke over the amount theoretically required is used. The atmosphere must contain a minimum of 25 percent hydrogen and may contain carbon monoxide in amounts up to, but not exceeding, the amount of hydrogen. The balance of the atmosphere is inert gases. The briquettes must be from 25 to 50 percent porous. After reduction the briquettes are cooled to below 250 F and then pulverized to give a powder substantially carbon free.

Process of Production of Iron Powder—U.S. Patent No. 2,759,808—Jerome F. Kuzmic and Warne P. Schenck—assigned to Alan Wood Steel Co.—issued August 21, 1956.

AJAX MERGER ANNOUNCED

Ajax Engineering Corp. of Trenton, N.J. and Ajax Electric Furnace Corp. of Philadelphia, Pa. have combined their engineering, manufacturing, and sales efforts. Inquiries, orders, and services are now being handled by Ajax Engineering Corp.

verized to give a powder substantially carbon free.

Process of Production of Iron Powder—U.S. Patent No. 2,759,808—Jerome F. Kuzmic and Warne P. Schenck—assigned to Alan Wood Steel Co.—issued August 21, 1956.

A POWDER METALLURGICAL PROCESS in which solid and hollow articles are made from a mixture of iron powder, approximately 1 percent by weight of graphite and 5 percent by weight of lead powder. The mixture is pressed at approximately 5 tons per sq. cm. and sintered at 1100 C for about 3 hours. The billet thus prepared is then extrusion-pressed into the desired shape.

Articles of Sintered Iron and Method of Making Same—U.S. Patent No. 2,759,810—Max Koehler, Herbede, Germany — issued August 21, 1956.

A POWDER METALLURGICAL PROCESS for making articles of high strength. Iron and graphite powders are mixed in the desired proportion and briquetted under pressure to a density of about 75 percent of the theoretical density of the article. The part so formed is then sintered under suitable conditions of time, temperature and atmosphere to form a strong, porous metal article in which the carbon is in the combined form. The article so made is then hot forged to give the final shape and size desired and to a density of at least 95 percent of theoretical. The forging is done so that the final shape of the article is achieved by one direction of movement and so that the internal flow of particles within the article is at least 5 percent.

Method of Manufacture of Articles from Metal Powders—U.S. Patent No. 2,757,446—Alfred L. Boegehold, Paul J. Shipe and Athan Stosuy—assigned to General Motors Corp.—issued Aug. 7, 1956.

A METHOD OF INHIBITING the reaction between easily oxidizable metals and permeable gypsum plaster molds free from lime. The mold material contains as additions at least one reaction inhibitor of the group consisting of boric acid, alkali fluoride, alkali borofluorides and alkali silicofluorides and from 0.2% to 5% by weight of urea formaldehyde resin. The mold is formed and dried to the extent that it does not contain more than 5% by weight of free water but does retain the water of hydration in the plaster.

Patent No. 2,753,608—Non-Reactive Gypsum Plaster Mold and Method of Casting Therein — William E. Nolan — assigned to Aluminum Co. of America — issued July 10, 1956.

A SINTERED, UNITARY POWDERED METAL thrust bearing. Porous metal powder bearing material contains from 1 to 3 percent graphite, 1 to 10 percent of an intermediate alloy of nickel and titanium and the balance iron powder. The porous bearing material is integrally attached to a support portion formed to a density and ductility greater than the porous portion.

Powdered Metal Bearing—U. S. Patent No. 2,763,519—Robert F. Thomson—assigned to General Motors Corp.—issued Sept. 18.

METHOD OF PREPARING a rare earth master alloy containing both magnesium and nickel in addition to the rare earth metal. Approximately 500 parts by weight of magnesium are melted and approximately 2000 parts by weight of nickel added to the melt. With the nickel-magnesium alloy in a molten state at approximately 1233 to 1343C, about 1313 parts by weight of a rare earth fluoride are added.

U. S. Patent No. 2,771,359—Rare Earth Master Alloy—Simon J. Morana—assigned to The Beryllium Corp.—issued Nov. 20, 1956.

COBALT BASE ALLOY COMPOSITION having excellent stress-rupture characteristics at 150 F. The alloy consist of 0.20 to 0.30 percent by weight of carbon; 0.40 to 1.00 percent by weight of manganese; 0.20 to 0.40 percent by weight of silicon; 25.00 to 35.00 percent by weight of chromium; a maximum of 4.00 percent by weight of nickel; 4.00 to 6.00 percent by weight of molyndenum; a maximum of 2.00 percent by weight of iron; 2.00 to 4.00 percent by weight of tantalum; and the balance cobalt.

U. S. Patent No. 2,771,360—Cobalt Base Alloy—Vincent T. Malcolm—assigned to The Chapman Valve Mfg. Co.—issued Nov. 20.

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FOR THE RIGHT FINISHING HEAD

Totally enclosed fan-cooled motor (3 and 5 HP, 1750 RPM and 7½ HP, 3450 RPM).

Sturdy steel column with 14" vertical movement.

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MODEL 50-81

1½ HP to 25 HP — Floating or non floating types for use with buffs, wire or tampico brushes or abrasive belts. Accessories include AIR LIFT — POWER WHEEL FEED — POWER TRAVEL (VERTICAL OR HORIZONTAL) OSCILLATING SPINDLE. Tell us your problem and let us quote on your requirements.

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PMM PEOPLE

changes & appointments

Carl C. Clabaugh has been appointed manager of the metal cleaner department of *Cowles Chemical Co.* He previously was metal cleaner sales manager.

George Karian has been named manager of the Tabletting Div. of *F. J. Stokes Corp.* He will supervise product design, sales, and customer service for the company's hydraulic and mechanical compacting presses.

Emil Fischer has been appointed resident New England sales engineer for the *Sel-Rex Corp.* Sales engineer for the midwest is **Peter Stevens.**

Donald L. LaVelle has been appointed assistant product manager for *Kaiser Aluminum & Chemical Sales, Inc.'s* pig and ingot products.

Malcolm Petrie has been appointed assistant sales manager of *Shell Process, Inc.*

George J. Baurle has been named sales engineer for *Oberdorfer Foundries, Inc.* He will cover the Western New York and Western Pennsylvania territory.

Roger Metzler has been appointed sales manager of *WaiMet Alloys Co.*

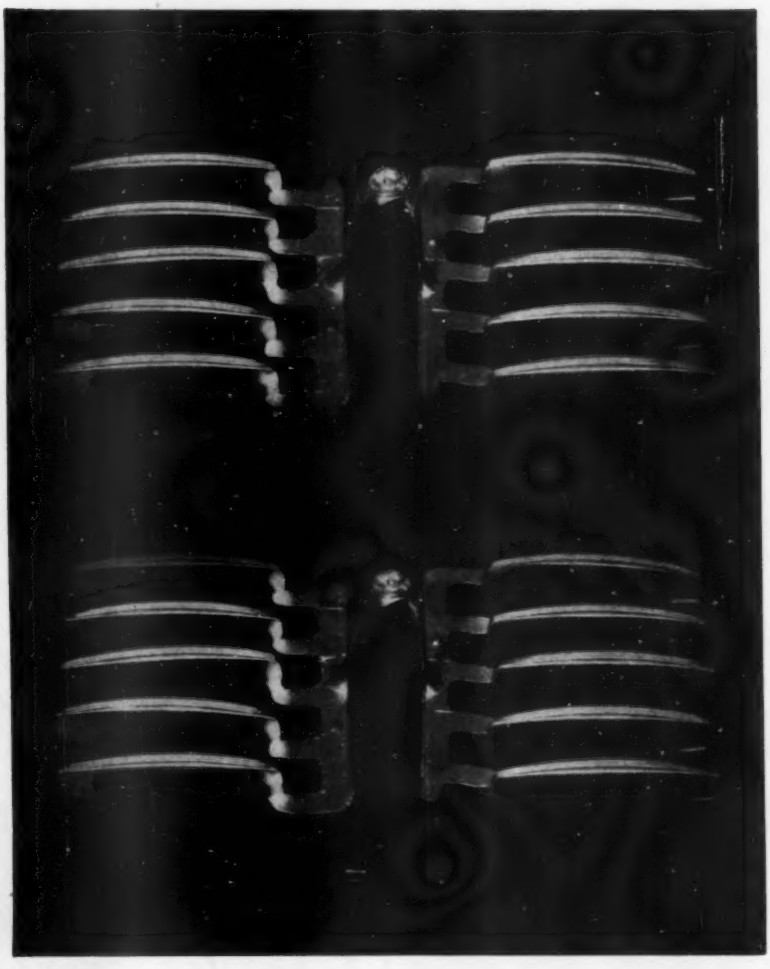
The *Seymour Mfg. Co.* has named **Eugene N. Castellano** manager of the company's bright nickel department.

Louis D. Martin has been named consultant to *Keystone Carbon Co.'s* gear department.

The appointment of **Charles E. Bagwell** as chief engineer has been announced by *Hanson-Van Winkle-Munning Co.* Mr. Bagwell will be in charge of all equipment design and engineering.

John E. Gotheridge has been named technical service manager for *Foundry Services, Inc.* He will head the company's recently-expanded technical service facility. **Jack W. Giddens** has been appointed technical service engnieer in the same division. FOSECO has also announced the appointment of **Frank S. Bilton** as purchasing agent and traffic manager.

Two appointments have been announced by *Baird Associates-Atomic Instrument Co.* **Wilburt M. Draisin** has been named promotions manager and **Arthur L. Krasnow** is the assistant sales manager.



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a zinc base alloy of high purity, produced in three grades to meet all required mechanical properties.

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Even if the alloy you buy casts correctly, brings out fine detail and takes a good finish, you may not be getting the consistent quality you think you are.

Minor variations in certain ingredients can change the characteristics of any alloy. If your die casting is a working part this can be critical. Toughness or strength may not reach the limits you designed for. The safety factor you expected may be missing.

Many people buy Federated die casting alloys because they know every heat is spectrographically and chemically tested to make sure chemical and performance specifications are met exactly. This constant quality check is conducted under the supervision of ASARCO's Central Research Laboratory, where metal impurities can be controlled to parts per million.

Don't believe loose quality-control claims. Check on them. Your Federated representative will be pleased to tell you why we give you a top-quality product, identical in characteristics, every time you buy from us.

Federated Metals

ASARCO

Division of

AMERICAN SMELTING AND REFINING COMPANY

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For more information circle No. 49 on the Reader Service Card

T. W. McKee has been appointed district sales representative in the Cleveland area by *Western Metal Co.*

W. H. Bennett has been appointed president of the *Hydraulic Press Mfg. Co.*, a division of *Koehring Co.* Mr. Bennett was formerly vice president in charge of sales. He succeeds **John C. Coonley,** who recently resigned.

Albert Schrage has joined the product development department of *Celanese Corp. of America, Chemical Div.*

Edward H. Jacobs has been appointed works manager of *Abrasive Machine Tool Co.* He will supervise production of the company's line of surface grinders.

The appointment of **E. C. Sargent** as president of the *Zirconium Corp. of America* has been announced. Mr. Sargent was formerly vice president and general manager.

Francis A. Noll has been named director of engineering of *Amana Refrigeration, Inc.* He previously served as cabinet engineer for Amana.

James R. Ireland was recently appointed director of research and engineering at *The Indiana Steel Products Co.*

M. D. McQuary has been appointed purchasing supervisor for *Chrysler Corp.'s Forge and Foundry Div.*

J. Douglas Patrick has been named product development engineer by *MacDermid, Inc.*

National Research Corp. has appointed **Phillip J. Clough** director of the metallurgical research department

James W. Pollard Jr. has been appointed chief engineer of the *Glidden Co.*

The election of four *Allegheny-Ludlum Steel Corp.* officers has been announced. **Carl B. Pollock** has been elected vice president in charge of manufacturing planning and policy; **Merle J. Graham,** vice president in charge of production; **Dr. Rush A. Lincoln,** vice president and technical director; and **John E. Groves,** vice president, industrial relations.

Rawson L. Wood, president of *Arwood Precision Casting Corp.*, was elected chairman of the Council of Profit Sharing Industries at its recent annual conference. He succeeds **Harold V. Lush,** president of *Supreme Aluminum Industries, Ltd.*

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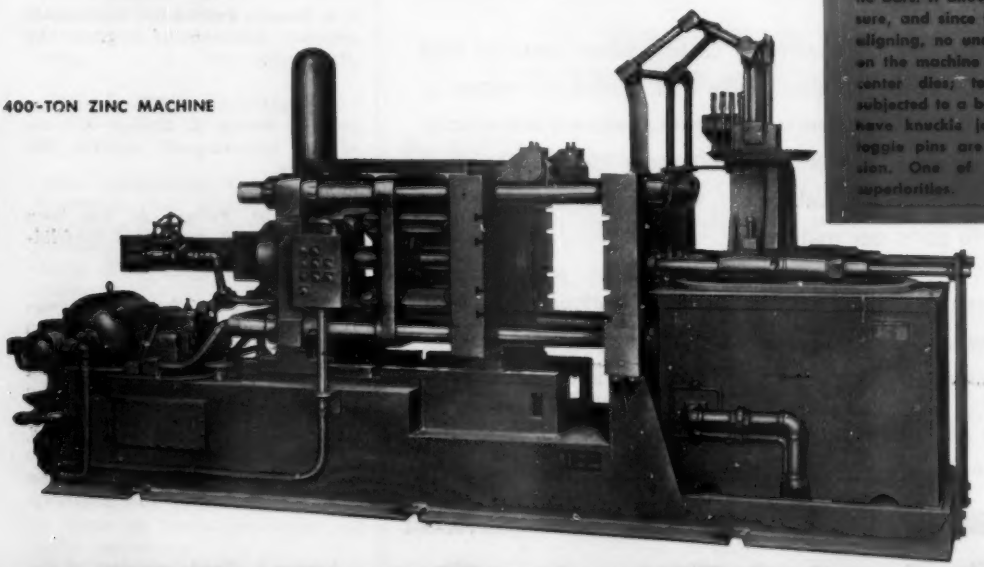
In many industrial centers you'll find leading die casters using B&T die casting machines — purchased by smart production men who, having carefully investigated and compared, choose them in preference to all others. These men know that for castings of extreme accuracy, excellent density and finish, B&T Die Casting Machines can not be beat. And, furthermore, that they'll give you top production with a minimum of maintenance.

13 MODELS thoroughly proved by many years of actual service — ranging in capacity from 100 to 750 tons — for zinc, aluminum and brass. EACH DESIGNED AND BUILT TO THE SPECIFICATIONS OF PRACTICAL DIE CASTERS AND DEVELOPERS OF DIE CASTING MACHINES WITH OVER 35 YEARS OF EXPERIENCE.

400-TON ZINC MACHINE



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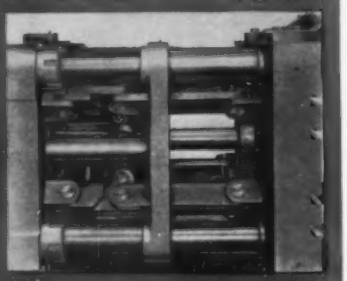

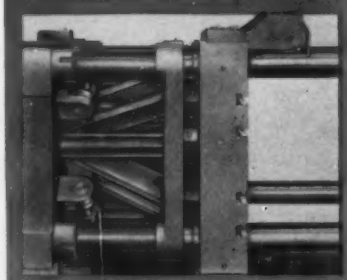

The 4-toggle linkage, an exclusive B&T feature, locks directly under the tie bars. It allows high locking pressure, and since the toggles are self-aligning, no undue strain is exerted on the machine when operating off-center dies; toggle pins are not subjected to a bending load. Toggles have knuckle joints so the fitrited toggle pins are placed in compression. One of many definite B&T superiorities.

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USEFUL LITERATURE, CATALOGS, MANUALS

any of these technical publications may be obtained by circling the appropriate numbers on the Reader Service Cards, Pages 16-17

PMM PROCESSES

Die Casting Facilities: 154
Precision Castings Co., Inc., Div. of Harsco Corp., 20 pages. A two-color illustrated booklet describes the company's die casting plants and facilities. Design, die making, casting, and finishing operations are included.

Die Cast Zinc Gears, Pinions: 155
Gries Reproducer Corp., single-page bulletin. Gear and pinion combinations available from stock die elements are described. More than 40 individual units are listed, all cast by the company, with holes, shafts, spacers, and shoulders made to specifications.

Solving Shell Molding Problems: 156
Barrett Div., Allied Chemical & Dye Corp., 32 pages. This illustrated booklet describes the shell molding process for casting metals with particular emphasis on the foundryman's problems. Design and production problems such as cost, machinery, gating, resin bonding, metals, and sand reclamation are among the points covered.

Buying, Specifying Investment Cast Alloys: 157
Precision Metalsmiths, Inc., wall chart. Designed as a quick-reference information source for buyers and engineers, the chart tabulates all important physical and mechanical properties of 26 ferrous and nonferrous alloys used in investment casting.

Powder Metallurgy: 158
New Jersey Zinc Co., 4-page tabloid folder. A recent issue of "Metal Powder Press" describes several new applications of sintered brass and nickel silver.

Zinc, Aluminum Die Casting: 159
Jersey Plastic & Die Casting Co., 6-page, 2-color folder. The company's die casting facilities are described in an illustrated folder. Both casting and finishing operations are covered.

Copper Alloy Shell Molding: 160
Aurora Metal Co., 6-page, 2-color folder. The shell mold process as applied to copper base alloy castings is discussed. The historical development of the process is reviewed, and some present typical applications are illustrated.

Powdered Metal Applications: 174
Merriman Bros., Inc., Powdered Metal Div., 4-page folder. Bulletin #45 describes the company's uses of powdered metals in the manufacture of pole pieces, helical gears, spur gears, and other parts. Listed are advantages offered through the use of the company's facilities.

Selecting Investment Casting Alloys: 175
Hitchiner Mfg. Co., Inc., 2-page illustrated brochure. A recent issue of "Engineering Slants" published by the company discusses considerations in picking the best alloy for investment castings. Functional requirements — weight, wear or shock resistance, machining — are covered. Savings in cost through the use of investment castings are also emphasized.

Powder Metal Parts: 176
Powdercraft Corp., 6 pages, 2-color technical folder. The use of powder metallurgy in the manufacture of machine parts, filter materials, metallic friction materials, self-lubricating bearings, and structural parts is described. Specification charts on filters and bearings are included.

MACHINERY & EQUIPMENT

Iron Powders: 161
Republic Steel Corp., 14 pages. This illustrated booklet describes the company's three new iron powders with their "CDF" features explained. The booklet includes charts of physical properties and 18 design pointers for powdered metal parts.

Die Casting Machine: 162
Cleveland Automatic Machine Co., 8 pages, 2 colors. The company's new "Model 600" die casting machine is described in this illustrated booklet. Specifications are given and several new features are described.

Induction Melting Furnaces: 163
Inductotherm Corp., 8 pages, 2 colors. Bulletin 70 describes the company's line of induction melting furnaces and related equipment. It includes installation photographs, complete product information, and performance tables giving melting times of various quantities of metals.

Die Cavity Blocks: 164
Richards Tool & Mold Co., single-page bulletin. Savings in die set-up time and expense through the use of the company's "Master-Mold" cavity blocks are described. Several sizes for aluminum and zinc die casting are illustrated.

Die Casting Machines: 165
A. Triulzi, S.A.S., 6-page 4-color folder. Six models of the company's pressure die casting machines are illustrated and described. Both hot and cold chamber machines are included.

High-Temperature Tubes, Insulators: 166
Morganite, Inc., 8-page 2-color booklet. Alumina and mullite tubes, insulators, and crucibles are described in this illustrated booklet. Included are two types of pyrometer protection tubes for uses at temperatures up to 3092 F.

Largest Die Casting Machine: 177
Cast-Master, Inc., 4-page illustrated folder. The company's model B-70-A die casting machine is described in this 2-color folder. Claimed to be the world's largest commercially built die casting machine, it produces aluminum die castings up to 75 pounds.

Guide to Silicon Products: 178
Dow Corning Corp., 12 pages, 2-color catalog and reference guide. Almost 150 commercially available silicon products are described in the 1957 issue of the company's reference guide and catalog. Products are grouped by useage — water-repellents, dielectrics, release agents, etc.—with brief descriptions. Numerous tables and graphs compare the products with the materials they displace.

Production Furnaces for Aluminum: 179
Lindberg Industrial Corp., 4-page illustrated folder. Furnaces for aluminum melting are included in a bulletin describing large size, field-erected production furnaces for all forms of metal heat treating. "Corr-therm" electric heating elements and "Vertical Radiant" gas-fired tubes are described, and several installations are illustrated.

Continued on next page

Do you need better ways to strip paint?

When tough finishes resist your present stripping methods, you may need help on some of these problems:

1 How to strip oil-base paints... synthetic enamels... alkali-resistant plastics... resin-base paints... japans... wrinkle finishes... nitrocellulose lacquers ...alkyds... phenolics... ureas.

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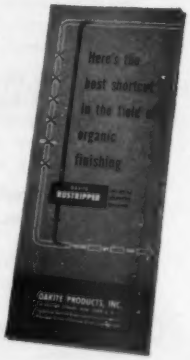

4 How to strip metal parts that are too large to be soaked in tanks.

5 How to strip paint, pigment residues, phosphate coatings and rust in one operation.

6 How to strip paint from rejects, conveyor chains, racks and hooks in continuous operation.

Oakite has more than a dozen fine stripping materials for these and similar jobs.

FREE For information on problems 1, 2, 3 and 4 ask for a copy of "How to STRIP PAINT". For more on problems 5 and 6 ask for "Here's the best shortcut in the field of organic finishing". Write to Oakite Products, Inc., 34G Rector St., New York 6, N. Y.

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USEFUL LITERATURE

continued from page 113

FINISHING

Plating, Processing Equipment: 167
The Meaker Co., 8 pages, 2 colors. Bulletin 856 describes and illustrates three machines — an automatic plating machine, the "Little Giant Utility" plating and processing machine, and an automatic barrel plating machine. Typical floor plans, cross section drawings, drives, construction, indexing, lubrication systems, draining, and optional features are included.

Polishing and Grinding Wheels: 168
Minnesota Mining & Mfg. Co., 12 pages, 3 colors. Uses of polishing and grinding wheels in a variety of industries are given in case history form in this illustrated booklet.

Drill Press Data: 169
Delta Power Tool Div., Rockwell Mfg. Co., 4-page bulletin. Bulletin AD-1011 gives descriptions and specifications of a new 20-inch drill press. Construction, capacity, and special features are covered, as well as listings of all 28 models offered in the 20-inch size.

Abrasive Selection Guide: 170
Pangborn Corp., 12-page illustrated manual. Bulletin No. 333 discusses blast cleaning abrasives — their characteristics, application, and selections. Tables of S.A.E. shot and grit sizes are given, along with photomicrographs of shot blasted and grit blasted surfaces.

Metal Cleaning Equipment: 171
Solventol Chemical Products, Inc. 4-page folder. This illustrated folder describes the company's specialized metal cleaning equipment and engineering services. Machine construction features are specified in detail.

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NEW SYNTHETIC FIRE-RESISTANT FLUIDS

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HOW A DOUBLE CONVERTER HOUSING WAS CAST IN ONE PIECE

By F. S. Ross, Vice-President in charge of Engineering Centr-O-Cast and Engineering Co.

The manufacturer of industrial engines had a problem: he needed a cast aluminum housing for a double hydraulic converter. The piece would weigh 70 lbs., and was highly complicated, involving cast-in hydraulic lines, a cast-in hydraulic sump, and numerous apertures, all of which had to be held to close finishing tolerances. Actually, the housing called for three castings, but to justify the design of the part, cost-wise, it seemed essential that it be cast all in one piece . . . and that was the problem.

Different casting methods were tried. Sand casting was attempted first, because it is usually economical. In this case, however, it was not, and the castings were poor. Permanent mold would give the required accuracy, but the intricate internal areas of the part presented a problem. The process that *did* work involved both of the two other techniques: semi-permanent mold. The exterior and the sump section of the part were formed in a permanent mold, while the top and half of the inside were formed in dry sand.

The permanent portion of the mold for this casting is a unique assembly. Rather than being a single mold, it consists of five separate outside shoes forming the exterior of the part, and these shoes move back and forth on five individual axes, making the total assembly similar to the petals on a flower. All are hydraulically operated, allowing us to cycle the mold properly.

We used a heavy riser for the casting, through a heavy dry sand core, with three separate pouring sprues on the flanges of the sump. By using a cover core, we were able to feed the heavy hydraulic oil-tight passages and still preserve the good dimensional accuracy of the permanent mold casting. The lower parts of the casting were very thick but quite sound, and the apertures and flanges were highly accurate. On all faces, only a minimum of stock remained to be machined. Because the casting when in use must withstand terrific strain, we had been concerned with getting sufficient wall thickness, but the finished piece proved that the original design for a ⅛" wall was more than adequate.

By casting this housing in semi-permanent mold, we succeeded in retaining the advantages of both permanent mold and sand casting. The finishing tolerances were very close, the structure was sound throughout, and the cost figure was excellent.

centr-O-cast

AND ENGINEERING COMPANY

45 St. Jean Avenue • Detroit, Michigan

55

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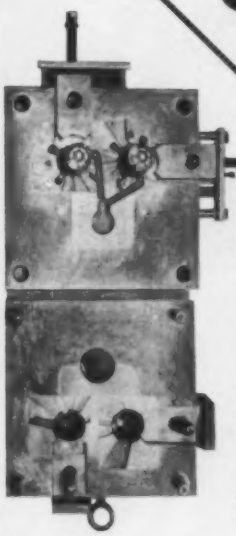
For more information circle No. 39 on the Reader Service Card

DIE CASTING DIES



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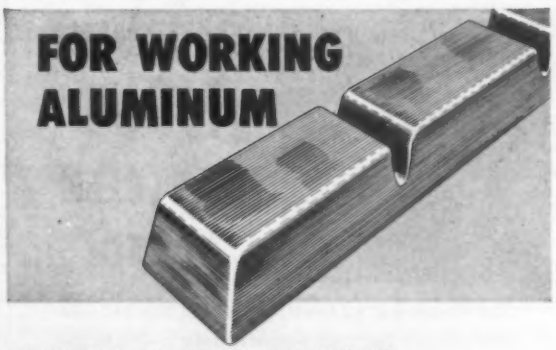

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- HIGH IMPACT STRENGTH
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producers of
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S.A.P.

continued from page 55

forged from bars. The blades may be stress relieved prior to surfacing without any loss in strength.

S.A.P. is the ideal material for forged *pistons*, and *cylinder heads*. On large pistons (Diesel), S.A.P. may be used in form of discs at the exposed bottom being exposed to high temperatures.

By using alloy additions, such as silicon, the low thermal expansion of S.A.P. pistons may be diminished to approximately 15.5 cm/cm/°C at 20 to 150 C. This way the operation properties may be substantially improved.

S.A.P. *sheets* may be considered for skins of *supersonic aircraft*. S.A.P. is especially suitable for *tubes* used as jackets for the uranium bars in *reactor engineering*, on account of its heat resistance, corrosion resistance and permeability for neutrons. *Tubes* are used for *heat exchangers* as well.

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Installation of a high temperature, atmosphere controlled fur-

SOMETHING NEW HAS BEEN ADDED:

The Vonnegut 32 brush polishing head is now available in *one* inch abrasive face width to get inside the most intricate metal or wood patterns! Your choice of either short or long-trim bristles for 32, 16 and 12 brush models. New design fits shorter spindles! Get the full story of this versatile tool—a "must" in every metal and wood working shop! Write for Bulletin No. 102.

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DECORATIVE PLATING

in our own plant that is specifically designed to finish zinc die castings in

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nace capable of reaching 3100 F, first of its kind in the Southern California industrial region, has been announced by the Powder Metals Division, Kwikset Locks, Inc. of Anaheim, Calif.

LINK-BELT COMPANY BUYS DETROIT FIRM

Acquisition by Link-Belt Company of Detroit Power Screwdriver Company, manufacturer of power-driven screwdrivers and related automated assembly equipment widely used throughout industry, has been announced by Robert C. Becherer, Link-Belt president and Roy W. Bailey, president of Detroit Power Screwdriver.

G. D. FRY HEADS NEW DIE CASTING DEPARTMENT

G. D. Fry

G. D. Fry has been appointed superintendent of the new Die Casting Department in the Chatham Division of Ontario Steel Products Co., Ltd., according to an announcement from E. S. Byers, president of the company.

Mr. Fry, well-known in the die casting industry in the United States and Canada, was associated with the Schultz Die-Casting Company for 25 years as chief engineer, director and director of sales.

A graduate of the University of Toronto in metallurgical engineering, Mr. Fry is also closely associated with various technical societies. He assumed his new duties as of November 1.

The combination of a hydraulic leak here, plus a tank of molten metal, could produce an instantaneous shower of flaming fluid around this die-casting machine . . . if it weren't equipped with Houghto-Safe.

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Flame Throwers

in your plant?

Every hydraulic machine that operates near high temperature hazards is a potential flame thrower . . . unless it is equipped with fire-resistant hydraulic fluid.

Be sure your plant and personnel are safe from hydraulic fire danger by installing HOUGHTO-SAFE in your hydraulic equipment *now*. You'll get complete fire safety—end your fire-danger worries.

HOUGHTO-SAFE 620 has passed the stiff Factory Engineering Laboratory flammability test for hydraulic fluids—is also standard in all Navy hydraulic aircraft carrier catapults. It won't attack packings. It is treated to prevent rust. It is non-toxic, gives off no unpleasant or dangerous fumes.

For higher continuous temperatures and pressures ask about Houghto-Safe 1000 Series. Write E. F. Houghton & Co., 303 West Lehigh Ave., Philadelphia 33, Penna.

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For more information circle No. 62 on the Reader Service Card

SOLUBLE CORES

continued from page 55

with this method is on those parts where the cored section is too small to subdivide for retraction. All factors being equal, however, it is recommended that a split section retractable core be used wherever possible on this type of casting.

The second method noted is that of using split section patterns which can be welded to form the whole. This is frequently used with both wax and plastic patterns and is quite a successful technique. However, some problems are inherent and to better illustrate this, a study of Figure 1 will clarify the explanation of the technique and its inherent problems.

The third method, using soluble wax cores, was finally used to overcome problems encountered in using the split section patterns and is also illustrated in Figure 1. The results of this method were most satisfactory.

A step-by-step diagram of the process is offered in Figure 2, showing a typical airfoil casting with soluble core, while other castings using this technique are presented in Figures 3, 4 and 5.

Although aircraft castings have been used here in demonstrating soluble core work, it should not be inferred that this method is feasible only for aircraft work. Many commercial castings with complex hollow shapes are successfully made with hollow cores. However, if a cored section can be produced satisfactorily by either of the two mechanical methods previously discussed, the use of soluble cores is not economical.

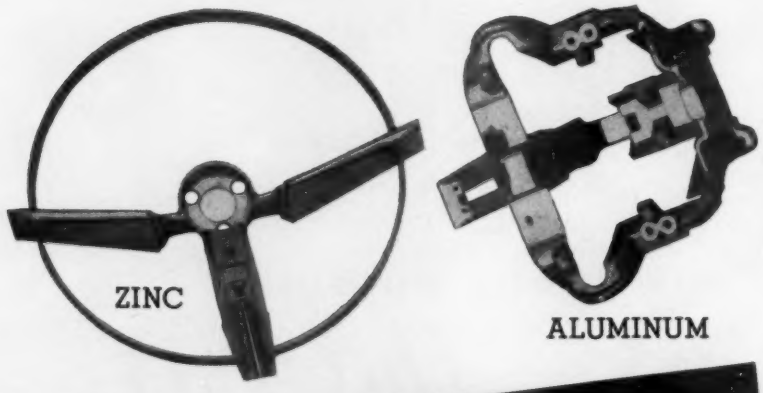
Experience of Misco with soluble waxes reveals some of the pitfalls that have had to be overcome.

The first efforts in this work with water soluble waxes were concentrated on the Carbowax materials. It was soon realized that these waxes were too weak by themselves to carry the applied loads and experiments were made with various fillers.

Silica flour was tried and considered quite satisfactory for smaller parts. As pattern injection loads were increased, other fillers were tried. Aluminum powder, glass fibers, and shreadded asbestos were used. These were found unsatisfactory for various reasons. For instance, the aluminum powder soluble cores were very strong and durable, but when the pattern wax was injected around it the aluminum particles would quickly transfer the heat from the injected wax causing the core to melt and run with the pattern wax.

A very suitable material was finally found in the use of 160 mesh powdered mica as a filler in Carbowax 4000. This wax was mixed with a ration of 1/3 mica to 2/3 Carbowax by weight.

This blend of Carbowax and mica was injected through an Alemite pump type machine. Wax temperature was maintained at 150 to 155 F and a pressure of 1000 to 1500 psi was most generally used. Silicone grease was used as a parting agent and dwell cycles during injection varied from 30 seconds to 5 minutes, depending on the mass of the injected core. This operating data is advised only as a guide and should not be construed as to apply to all types of patterns. Differences in mass, shape, etc., will require different techniques to determine the best conditions.



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just good
die castings**

The entire Pressure Castings plant is geared for the precision production of zinc and aluminum die castings—competitive in cost, high in quality. Large, medium and small die casting users can benefit from the advantages of buying "die castings from Pressure."

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TOLEDO SDCE ELECTS

Wesley Wright of the Chevrolet Motors Div. of Toledo was elected chairman of the Toledo area chapter of the Society of Die Casting Engineers.

Other officers named at the chapter's first meeting were: Charles Hodan, Ford Motor Co., Sandusky, vice chairman; T. E. Hansen, E. F. Houghton & Co., secretary; and trustees Roland Fulton, Chevrolet, Toledo; John Preas, Latrobe Steel Co.; and George Hodgson, Doehler-Jarvis Div., Toledo.

CONTROLLER ARM

continued from page 57

The choice of aluminum bronze was made originally because aluminum base alloys at that time (over twenty years ago) did not seem to have the necessary strength. With the alloys available today, this casting could easily be made in aluminum if it were active enough to warrant the change.

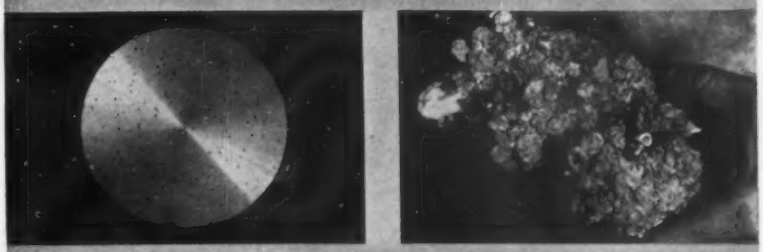
With such a change, many of the holes that are now drilled could be cored and the total amount of machining greatly reduced. It is also probably that the cost of metal in the casting would only be a fraction of the present cost. However, since the arm is now made only as a replacement item, new tooling is not justified.

Other than drilling the various holes that are not cored, the bore must be reamed and two bearing faces machined. As can be seen in the illustration, the intricately shaped cross member on one end is a separate piece fastened to the casting by riveting.

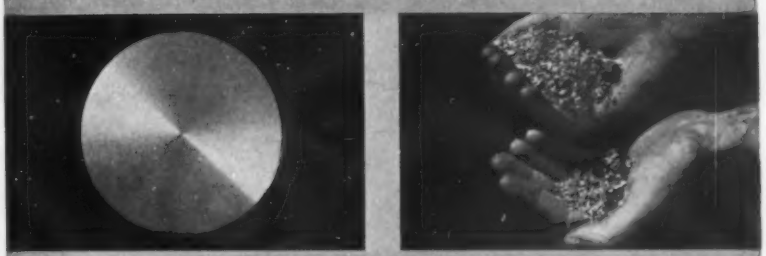
The knurling on the one end of the hub is broached and the slots in two of the legs are formed by the casting process.

One of the peculiar advantages of the permanent mold process is clearly demonstrated by this casting. As noted above, the part is now obsolete and only made for the replacement market. With almost any other method of fabrication, it would be necessary to make a rather elaborate set-up to make or finish these parts. The mold for such a casting, however, is easily stored and can be put into service in little more time than is required to bring it from storage and place it on the casting floor. Once on the floor when other castings in the same alloy are being made, the cost per part cast is little more than when the mold was in regular production. Further, all machining operations are simple and require no jigs, fixtures or special shop set-ups.

Costly gassy and oxidized aluminum castings and metallic drosses like these



are eliminated



with Foseco® Coverals and Degasers

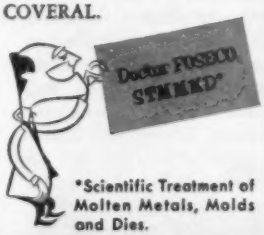
And it's so easy to produce sound aluminum castings the FOSECO way. Just:

(1) Heat crucible and charge ingot and/or scrap.

(2) Dust on a layer of FOSECO COVERAL.

(3) Melt charge completely and plunge FOSECO DEGASER TABLETS.

(4) Dross-off with another small quantity of FOSECO COVERAL.



*Scientific Treatment of Molten Metals, Molds and Dies.

THE PROBLEM

Tough oxide film which forms on the surface of untreated molten aluminum.

Suspended particles of oxide (alumina), some of which are in contact with hydrogen gas. The oxide film prevents the hydrogen from rising to the surface.

THE SOLUTION

Plunger

Foseco Coveral Flux has absorbed the oxide into the dross which can be easily and cleanly skimmed.

Foseco Degaser decomposes to:

1. Liberate chlorine vapors which combine with and effectively remove the hydrogen.
2. Sweep all other impurities, including oxides, to the surface.
3. Break the surface tension of the metal by dissipating the oxide film, completely removing the last traces of gas and entrained oxide from the melt.

THE RESULT

A clean, gas and oxide-free aluminum melt, ready for pouring. Drosses are exceptionally low in metallics, fluidity is improved and strong, pressure-tight castings are produced.

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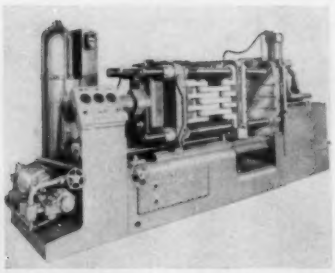
NEW PRODUCTS AND DEVELOPMENTS

Want complete details on these announcements? Use the Reader Service Cards. You'll find them facing page 16 of this issue

DIE CASTING MACHINE BUILT FOR FAST WORK



With special emphasis on safe operation, simple, efficient design, and ease of maintenance, a new die casting machine with a 450-ton capacity has been built to give more production with less operator effort.

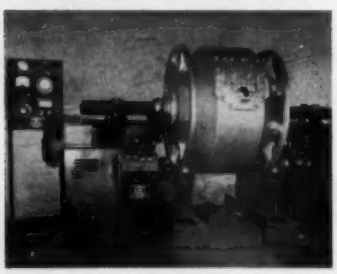
Among the 10 distinct features claimed for the machine are a simplified, compact and self-contained hydraulic system mounted on a sub-base of the machine. All pilot lines and the coupling of hydraulic pipes with welded flange fittings have been eliminated to reduce the possibility of oil leaks or hydraulic shock.

A simplified shot end design with an unusual adjustment device eliminates brute strength and large wrenches for cylinder adjustment. Only two nuts are needed for final clamping of nozzle to die.

To facilitate maintenance, all four tie bars can be pulled without dismantling any part of the machine. Tank cleanout has been simplified, with easily accessible oil filters. Tank drainage is not necessary.

Unit Products Div., Unilay Corp.
For more information, circle No. on the Reader Service Card

INDIRECT ARC FURNACES HAVE NEW CONTROLS



A new series of indirect arc furnaces have capacities from 350 to 4,000 pounds. Designated the "P" series, furnaces are pedestal mounted with completely new arc control system and motor-driven electrodes.

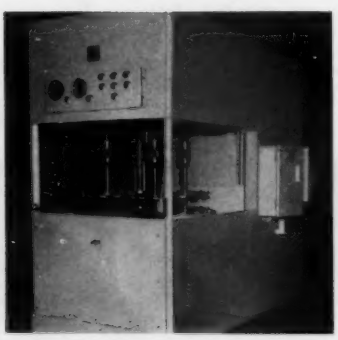
The magnetic amplifier type arc control permits variation in the speed of the control motor so its speed is directly proportioned to unbalance. Motor-driven electrodes are automatically controlled, but may also be moved by manual push-button controls.

All switches, push-buttons, and indicating lights are contained in a single box which can be placed in any location convenient for the operator.

Reported to require less floor space, the furnaces have KW ratings from 125 to 600.

Detroit Electric Furnace Div., Kuhlman Electric Co.
For more information, circle No. 183 on the Reader Service Card

FINISHING PROCESS ELIMINATES OLD METHODS



A recently-developed finishing process is claimed to offer a revolutionary change in methods for finishing brass, zinc base, and aluminum die cast parts preparatory to plating. Known as Spin-Buff, the process is reported to eliminate the need for older hand and automatic buffing methods.

Workpieces are mounted on racks which are immersed and rotated in a special-formula finishing compound. Handling a multiple mounting of parts in one automatically-timed operation, Spin-Buff is said to produce surface and luster comparable to or better than the results from conventional buffing.

Manufacturers report the following advantages: the need for elaborate blowers and exhaust-ventilating systems is eliminated because the new process is both dust-free and fume-free;

Spin-Buff saves material buffing costs because unusual parts which were difficult to process on buffs and wheels are now finished in a single operation.

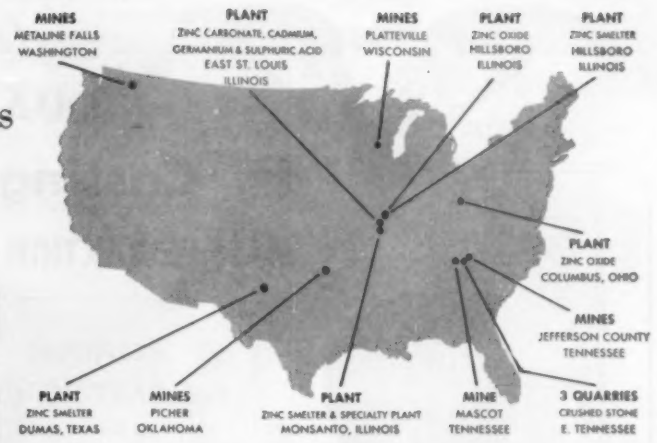
The process also effects labor economies because, in addition to running a number of like parts in a single set-up, groups of as many as four different parts can be run simultaneously.

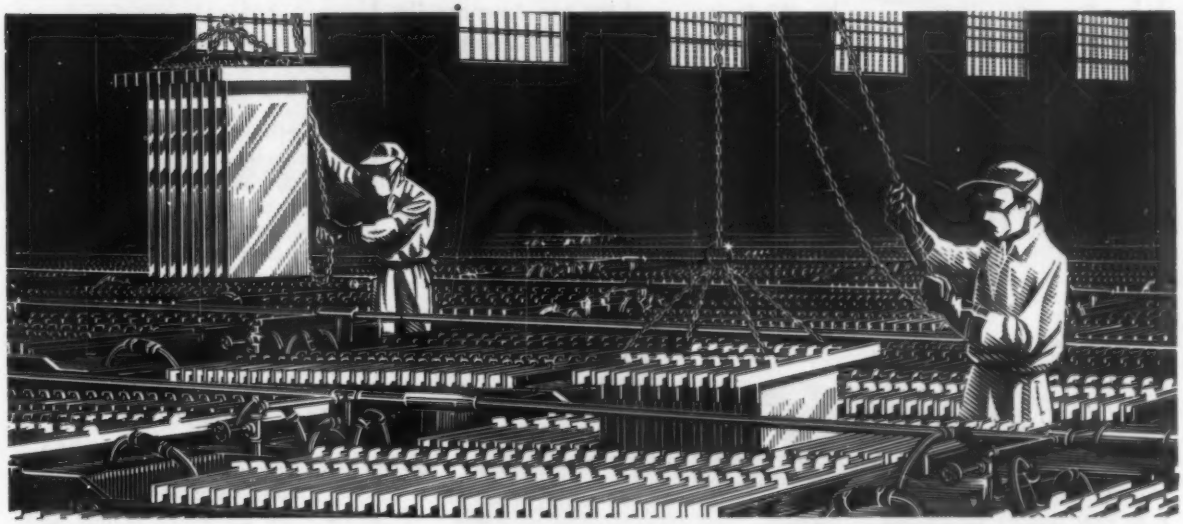
Operating cycles of the new process are reported to vary in time from four to 16 minutes. A special fixture on the machine permits locking or unlocking of parts with a single turn of a cam, further cutting set-up time and speeding production.

Grav-i-Flo Corp.
For more information, circle No. 182 on the Reader Service Card

American Zinc and its products

from A *to* Z





OPERATIONS AT MONSANTO, ILLINOIS

Modern and recently expanded electrolytic plant producing special high grade slab zinc, which is sold primarily to the die casting and brass manufacturing industries. In conjunction is a specialty plant for the production of zinc ball anodes, heavy plating anodes and anodes for cathodic protection. For complete picture of American Zinc operations, see map above.

PRODUCERS OF

ALL GRADES OF SLAB ZINC
ZINC ANODES (Plating & Galvanic)
METALLIC CADMIUM
SULPHURIC ACID
LEAD-FREE and LEADED ZINC OXIDES
ZINC CARBONATE
GERMANIUM DIOXIDE
AGRICULTURAL LIMESTONE
CRUSHED STONE

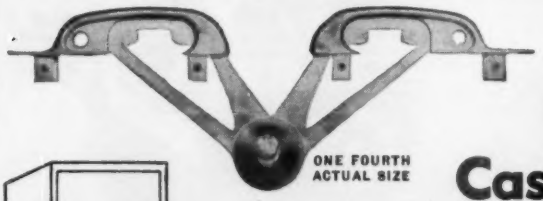
Distributors for

American Zinc sales Company

AMERICAN ZINC, LEAD & SMELTING COMPANY

Columbus, Ohio • Chicago • St. Louis • New York • Detroit • Pittsburgh

For more information circle No. 15 on the Reader Service Card



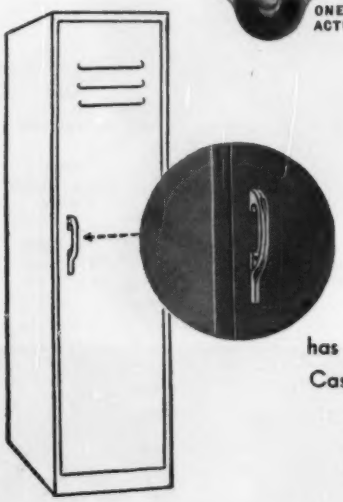
ONE FOURTH ACTUAL SIZE

for

QUALITY

Castings at

MASS PRODUCTION COSTS



HELFRICH

DIE CASTING CO.

North Canton, Ohio

RUSSELL P. HELFRICH, Owner

has this to say about the two American Die Casting Machines installed in his factory:

"Outperformed other machines used in previous years with more than twice the production, at lower operating cost."

American Die Casting Machine

Model 60HYD

Delivered Complete— READY-TO-RUN — NOTHING ELSE TO BUY!

OVER 1300 Free Cycles Per Hour —— Shot Capacity Up To **3 Lbs.**

Speed up your PRODUCTION . . . Increase your PROFITS!

*Since putting 2 Americans into production 13 months ago, Helfrich Die Casting Co., report they are now producing more and better castings per hour than ever before.

Now you too, can run high grade castings, up to 3 lbs., at high speeds and low operating costs. Actual tests operating 8 hours a day, 5 days a week, show total cost of gas and electricity of ONLY 17c PER HOUR!

Outstanding features include — all steel welded construction — automatic electric cycling at high speed—17¾" die platens—6½" die stroke—highest grade controls and valves mounted for easy maintenance and accessibility — a complete package with self contained unit.

Available in Air or Hydraulically operated plunger gooseneck type for zinc, tin or lead, or, cold chamber type for aluminum, brass and magnesium.

Write for Free illustrated folder containing complete data on all models.

AMERICAN DIE CASTING MACHINERY CO.

1524 W. Thomas St., Chicago 22, Ill. PHONE: Armitage 6-3334

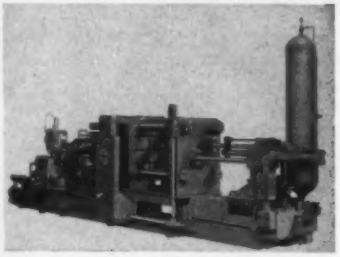
COMPONENTS

(Standard Equipment)

- **VICKERS** Hydraulic System
- **NORTH AMERICAN** Blower
- **SQUARE-D** Electrical Controls
- **GREER** Accumulator
- **MARVEL** Synclinal Filters
- **ROSS** Heat Exchanger

For more information circle No. 7 on the Reader Service Card

DIE CASTING MACHINE . . . offers 650 cycles per hour



A die casting machine with a rated locking tonnage of 250 tons is equipped with a cold chamber end for casting aluminum, magnesium, or brass. Capable of 650 free cycles per hour, the machine also features injection plunger speeds adjustable to 10,000 in. per minute, with pressure of approximately 33,000 psi on the injected material.

A self-compensating knuckled wedge cam toggle automatically takes up clearance in dies caused by heat expansion. The knuckled joint eliminates shear stress on the pins when under locking pressure.

Equipped with full pushbutton control in inching and semi-automatic operation, the machine is fully interlocked to assure maximum safety.

Lake Erie Engineering Corp.
For more information, circle No. 198 on the Reader Service Card

PLATING, ANODIZING . . . done automatically

A fully automatic plating and anodizing machine called the Cycleflox has been designed to eliminate the expense of overhauling or rebuilding during cycle changes.

The manufacturer reports that only the positions of the pick-up head require changing, plus minor tank partition adjustments. A simplified safety device and electro-mechanical control eliminate the possibility of conveyor malfunction and prevents racks being pushed into the side of the tank or the dropping of a load if power fails during work transfer.

Hydraulic operation and speed control on lift and transfer is standard on the machine. Pnuematic operation is optional, and the machine can be equipped for automatic loading and unloading from standard double-spine racks which can remain on machine while parts are unloaded.

Lasalco, Inc.
For more information, circle No. 184 on the Reader Service Card

ATOLS

TOOL AND MOLD CORPORATION

DESIGNERS & FABRICATORS

of

QUALITY MOLDS

for the

DIE CASTING INDUSTRY

Complete designing and engineering. Modern plant & equipment includes BG-21 4' x 6' & BL-3620 Keller Duplicators.

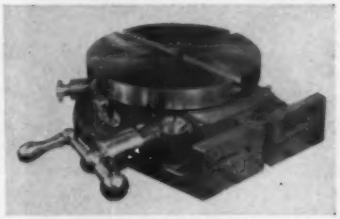
5005 West Armitage Ave.
Chicago 39, Ill.
BErkshire 7-0800

Circle No. 10 on Reader Service Card

TWO BRIGHTENERS
. . . for zinc, cadmium

A new brightener for zinc has been introduced. The zinc barrel brightener addition agent, ARP #52, produces a uniform lustrous deposit at a low cost per pound.

ROTARY TABLE
. . . has two-way operation



A 12-inch rotary table has been designed to simplify circular and rotary machining operations of all kinds. Incorporating a ground lead screw, the table features a base which permits both horizontal and vertical operation.

Two parallel clamping ears and adjustable keys are provided for location and clamping to a machine table in the horizontal position. The unit is bolted to the machine table through two 3-inch elongated slots.

Overall height in the horizontal position is five inches to give maximum tool clearance.

Universal Vise & Tool Co.
For more information, circle No. 195 on the Reader Service Card

METAL CLEANING SLUSHER
. . . ends hand labor

Quick cleaning of metal parts without hand labor is offered by a recently-developed motor-driven slusher. Material for cleaning is suspended in the cleaning or rinsing solution on a horizontal rod which moves on an arc.

The parts move up, down and sideways through the solution producing a slushing action which washes away dirt. The parts may be suspended on plating racks, in baskets or on wires. Electrical connection for electrocleaning is available.

Available complete with tank or furnished to fit present tanks, the slusher is equipped with a one-quarter hp drive motor for either single or three phase.

Belke Mfg. Co.
For more information, circle No. 186 on the Reader Service Card

Continued on page 128

Dodge Custom-made Special Alloy Steel Goosenecks

. . . for longer service life

. . . less maintenance

Here's the biggest news in die casting in years: a custom-made special alloy *steel* gooseneck that will outlast and outperform iron and alloy iron goosenecks currently available . . . and provide greater operational savings! Developed through years of experience and association with the die castings industry, Dodge Special Alloy *Steel* Goosenecks provide many advantages:

- Will outlast iron and alloy iron goosenecks by as much as 4-5 years.
- Maintenance problems are fewer because of long service life.
- Down time is reduced to a minimum because of long service life.
- Designed and made of special alloy *steel*, they prevent cracking . . . bottom breakout . . . spout erosion.

Each Dodge Special Alloy *Steel* Gooseneck is custom made to specifications by the Finished Products Division of Dodge Steel Company. Facilities are available for producing any size gooseneck for any die casting machine. Goosenecks are furnished either rough machined or machined with sleeves. Dodge provides a complete engineering service in the designing and production of steel goosenecks.

Your inquiries are solicited, without obligation, of course. Ask too, about pots and other die casting machine parts including nozzles, spouts, plungers, etc.

DODGE STEEL COMPANY

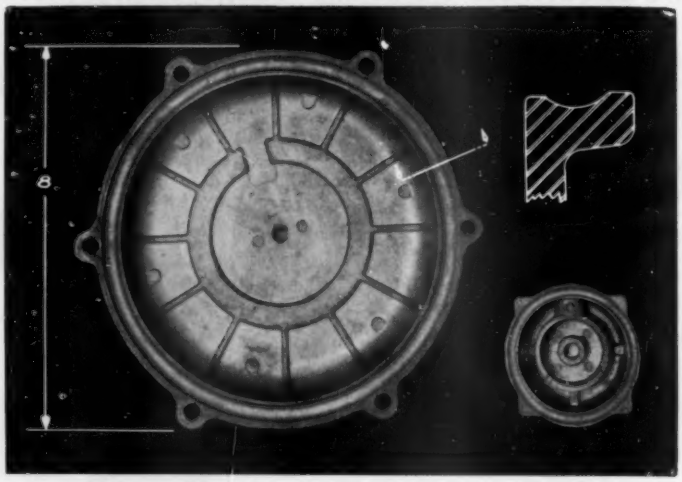
DS

FINISHED PRODUCTS DIVISION
6501 Tacony Street
Philadelphia 35, Pa.

THE MOST IMPORTANT ALLOY IN A STEEL CASTING IS QUALITY

Circle No. 42 on Reader Service Card

For more information circle No. 45 on the Reader Service Card



As cast aluminum die castings are specified for regulators with 90 PSI test and rubber diaphragms. Costly machining and impregnation are eliminated.

Federal
DIE CASTING COMPANY
2220 NO. ELSTON AVE. CHICAGO 14, ILL.
Phone AR-6-4803

MELTING ALUMINUM?

new, improved Haviland Flux for dry dross at lower operating temperature

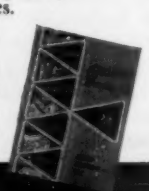
Get greater metal-dross separation with our new, improved 4B Aluminum Flux. Safe and virtually smokeless, gives better alloys, makes pulverizing or mechanical separation unnecessary. Works *safely* in any type of furnace and at low temperatures (1250° F.) where other fluxes may fail.

OR ZINC?

Haviland 3G Zinc Flux gives complete dross separation, means greater metal savings — often *four times* greater. And you need *less* flux — sometimes 50% less. Completely safe. No acrid, stinging fumes to irritate employees.

DISTRIBUTORSHIPS STILL AVAILABLE

FREE TECHNICAL BULLETIN
gives important information on fluxing procedures and improved shop practice. Write for your copy.



Haviland PRODUCTS COMPANY
421 Ann Street, N.W. Grand Rapids 4, Michigan
Manufacturers of processing chemicals for the metal trades

For more information circle No. 56 on the Reader Service Card

OPPORTUNITIES

jobs & equipment

Opportunities rates: $20 for the first column-inch; $15 for each additional column-inch payable in advance. To answer box number advertisements, address responses to the box at Precision Metal Molding, 812 Huron Rd., Cleveland 15, Ohio. Closing date: 1st day of month preceding publication.

POSITIONS OPEN

WANTED — Sales Manager experienced in powder metal parts wanted by well established sinterer. Advise qualifications and salary arrangement desired. Write Box No. 1557.

REPRESENTATIVES WANTED — We are changing our sales policy and are interested in discussing the sales of our melting furnace equipment with representatives in various districts outside of New York and Chicago. We manufacture a complete line of gas and oil nonferrous melting furnaces in all sizes and types. Also interested in a salesman for our home office. Write Stroman Furnace & Engineering Company, 9900 Franklin Avenue, Franklin Park, Illinois.

POWDERED METALS
PROJECT ENGINEERS

●

Experienced in production and development with metallurgical, mechanical or electrical background. Must be capable of supervision over salaried and hourly personnel on presses, furnaces, etc.

Experience in tool design and fabrication is desirable. Will work with iron, brass, bronze and alloy powders.

Excellent opportunities for advancement in new division of large corporation. Liberal benefits and salary commensurate with experience.

Most modern plant designed for powdered metals production. In rural location close to large industrial areas.

EATON MANUFACTURING CO.
POWDERED METALS DIVISION
COLDWATER, MICHIGAN

POWDERED METAL PROJECT ENGINEER — Must be able to assume full responsibility for process, tool design, try-out and acceptance of sample, made of powdered iron. Some experience in powdered brass and bronze desirable. 3-5 years in powdered iron. Relocate. Submit resume of experience in first reply. Write Box No. 1357.

SALESMEN — DISTRICT SALES MANAGERS — Leading manufacturer of investment castings has several openings for aggressive sales engineers and two district sales managers. Experience in foundry practices essential. Excellent opportunities and income potential for technically qualified sales personnel. Company benefits and incentive plans. Write Box No. 1457.

SALES REPRESENTATIVE — Aluminum, bronze, magnesium castings — Should be well versed in foundry practices in sand, permanent mold and die casting operations. Develop new territory with good potential. A fine opportunity for a well trained, ambitious person. Person should be familiar with Western Pennsylvania and Western New York territory. All replies treated in strict confidence. Oberdorfer Foundries, Inc., Syracuse, New York.

POSITIONS WANTED

POSITION WANTED — Investment casting Grad. ME, 31. Wide managerial, sales, tooling and process experience, past 7 years. Energetic administrator. Proven inventive and design ability. At present General Manager medium sized foundry in Europe. Returning to U. S. early 1957. Seeks position of responsibility with ambitious, progressive organization. Actual size and location immaterial. All suggestions considered, including those from equipment or ancillary producers. Write Box No. 1157.

EQUIPMENT

WANTED — Cleveland Die Casting Machine — 200 ton, zinc or aluminum. State age and price in first letter. Write Box No. 1257.

DIE CASTERS — 2-7 lb. shot capacity Stork die casters, new 1940, completely hydraulic. Price, guaranteed — each $5,500.00. Mohawk Machinery Co., Cooper & Apple Sts., Cincinnati 23, Ohio.

FOR SALE — 275 ton Reed-Prentice 1½ G die casting machine. 1952 model. Convertible to either hot or cold chamber. Withrow Die Casting Co., 13164 Leadwell St., North Hollywood, California.

WANTED — Aluminum die casting machine, good condition, 500-600 ton. Write Box No. 1757.

The hob (1) a replica in hard tool steel of the finished piece, is pressed into steel blanks to produce hobbed cavities (2) which are then machined (3) for insertion into a die shoe or mold frame.

CUT TOOL COSTS WITH NEWARK DIE HOBBED CAVITIES

Die hobbing is often the key to lower tool costs. This process produces steel cavities with a minimum of machining, filing and polishing operations . . . and adds the insurance of maximum uniformity in multiple cavity molds or dies.

What's more, as the steel alternately flows and condenses under the hobbing pressure, the mold takes a closer surface grain structure that more faithfully reproduces detail in the finished product.

NEW!

Write for your free copy of "How and When to Hob." Or let us discuss directly how Newark's complete die hobbing facilities and experience with all sizes and types of cavities may benefit you. No obligation, of course.

NEWARK DIE HOBBING AND CASTING CO.

20 SCOTT STREET, NEWARK 2, N. J. PHONE MArket 2-3305

For more information circle No. 85 on the Reader Service Card

HUMIDITY INDICATOR
. . . covers entire range

A humidity measuring element has been designed to measure the full range of humidity from zero to 100. Called the Hygropak, it operates on a different principl from other humidity elements.

Grid electrodes within the element are coated with a specially-developed substance which sets up energy bands controlled by water molecules in the air.

The element will operate over a wide range of temperatures up to 200 F, the safe temperature limit for the plastic case. For higher temperatures, an all-glass unit can be made which will operate up to 600 F.

Photo-Crystals Inc.
For more information, circle No. 197 on the Reader Service Card

EMULSION CLEANER
. . . removes buff compounds

An organic cleaner to remove heavy oils, greases and soils is now available. Known as Emulsion Cleaner #26, it can be used prior to an alkaline cleaner to cut cleaning time and increase the life of the alkali cleaner. The cleaner will also remove buffing compounds. It is used at room temperature for cleaning all ferrous and non-ferrous metals.

Mitchell-Bradford Chemical Co.
For more information, circle No. 196 on the Reader Service Card

PRESSURE VALVE
. . . has broad range

Two new, low-pressure type, pressure-reducing valves now available for industrial oil-hydraulic systems feature an unusually broad pressure adjustment range.

They are reported capable of providing any controlled reduced outlet pressure from 25 to 1,000 psi.

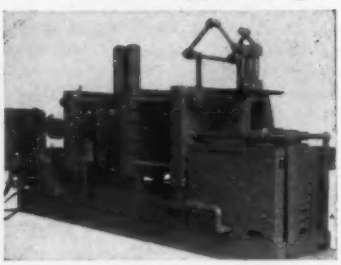
Both new valves are for use with ⅜-inch nominal pipe size in systems having operating pressures up to 2,000 psi. Model XGL-03-B is gasket mounted; model XTL-03-B is provided with pipe thread connections.

Both models are nominally rated at eight gpm flow capacity. Free reverse flow is allowable provided pressure at the reduced pressure port does not exceed the reduced pressure setting of the valve.

Vickers Inc.
For more information, circle No. 194 on the Reader Service Card

CHOOSE
JOHNSON
PRESSES
for
BETTER,
FASTER
PRODUCTION
REGULAR OBI
23 models from 16 to 150 tons capacity, pin or air clutch, flywheel or back geared.
HIGH SPEED
All models now available with Varidrives up to 300 SPM, bronze gibs, air clutch.
WIDE OBI
Three models: 33-27 ton; 44-43 ton; 55-56 ton. Extra large bed area, die space and shut height. Flywheel or back geared.
GAP DOUBLE CRANK
Steel fabricated up to 150 ton capacity. Built to customer's specifications.
STRAIGHT SIDE DOUBLE CRANK
Steel fabricated up to 150 ton capacity. Built to customer's specifications.
WRITE FOR BULLETIN 1956
Johnson
MACHINE
and PRESS CORP.
620 WEST INDIANA AVE. • ELKHART, INDIANA
For more information circle No. 66 on the Reader Service Card

DIE CASTING MACHINE
. . . has four-toggle linkage



A new 600-ton zinc and aluminum die casting machine features a four toggle linkage that locks directly under the tie bars which permits high locking pressures without strain to the machine.

Because the toggles are self-aligning, toggle pins are not subjected to a bending load when the machine is operating with off-center dies.

The hydraulic system, made for maximum speed, accessibility, and efficiency, is designed with electric and hydraulic interlocks to eliminate the open shot menace. In the closing cycle, the die is fully locked before the electrical circuit will allow a shot.

In case of an electrical failure, a hydraulically-operated pilot check valve in the shot line also prevents an open shot.

Automatic lubrication to all toggle pin moving surfaces can be provided, giving a predetermined amount of lubrication each day. Maximum weight per shot is nine pounds for aluminum and 20 pounds for zinc. The machine is furnished with cooler, furnace and pot.

B & T Machinery Co.
For more information, circle No. 181 on the Reader Service Card

PRESSURE-COOLED BUFF
. . . removes residue

Two new buffs, designed especially for finishing of die castings and permanent mold castings, have recently been announced. Known as Type K and Type Q pressure cooled buffs, their action is claimed to remove excessive buffing compound residues from parts being buffed, leaving a cleaner finish preparatory to the plating cycle.

Manufacturers report that their cost ranges from 20 to 50 percent below the cost of usual ventilated buffs.

United Buff Products Corp.
For more information, circle No. 188 on the Reader Service Card

MOLYBDENUM PELLETS
. . . for vacuum melting

High density and high purity molybdenum pellets designed for vacuum melting processes used in the manufacture of critical high-temperature alloys are now being produced in quantity.

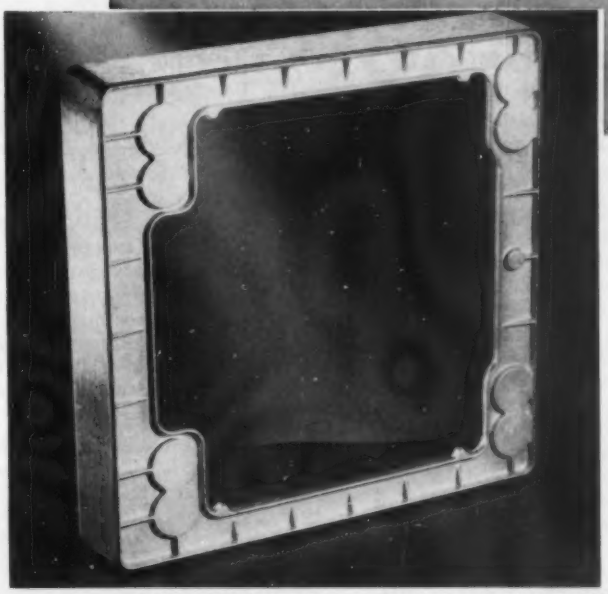
The pellets are approximately 99.85 pure molybdenum with a density of seven g/c.c. and a gas content of about 300 ppm.

Sylvania Electric Products, Inc.
For more information, circle No. 189 on the Reader Service Card

Continued on page 143

For more information circle No. 43 on the Reader Service Card

aluminum . . .
- permanent mold castings
- die castings



Thin wall—as low as .070"

High production—low cost

Sturdy Construction—eliminate machining

EASTERN CASTING CORP. DIVISION
THE EASTERN MALLEABLE IRON CO.
64 South William Street, Newburgh, New York

FIGHT HEART DISEASE

Help Your Heart Fund
Help Your Heart

6 GOOD REASONS
Why You Should Specify
MERRIMAN POWDERED METAL PARTS

1. HIGHEST QUALITY — ALL WAYS
2. GUARANTEED TO FIT
3. DIMENSIONALLY ACCURATE
4. PROVEN PERFORMANCE
5. LOW COST
6. FASTEST DELIVERY

Originators of Sintered Helical Gears
High Density, precision structural parts from powdered metal in
Brass, Bronze, Copper, Nickel Silver Steel, Iron and Iron Alloys. Copper Infiltration

POWDERED METAL DIVISION
MERRIMAN BROS., INC.
185 Amory Street Boston 30, Mass.
REPRESENTATIVES IN PRINCIPAL CITIES

P.O. Box 405, Berkeley, Calif.
33 University Ave., Rochester, New York
1011 Main St., East Hartford, Conn.
4324 W. Florissant Ave. St. Louis, Missouri
3092 Livingston Rd. Cleveland, Ohio

For more information circle No. 76 on the Reader Service Card

NEWS OF INDUSTRY & ASSOCIATIONS

activities of people, companies & groups in the precision metal molding industries

MACHINE STANDARDIZATION PROGRAM UNDERTAKEN BY DIE CASTING ENGINEERS

Procedures for establishing die casting machine standards were put into motion at a meeting of the Standards Committee of the Society of Die Casting Engineers in Detroit, November 30. Primary objectives arrived at by the 17-man session include the development of a uniform method of measuring machine clamping tonnage, standard platen data to permit interchangeability of die mounting, and uniform methods of rating and nomenclature for equipment.

Following a pattern set by the manufacturers of plastic molding and disc grinding machines, the committee intends to provide a standard basis for machine comparison without infringing upon the design prerogatives of the builders of die casting machines.

Attending the committee meeting were representatives of both captive and contract die casting shops, as well as manufacturers of equipment and die components. Meeting chairman was M. R. Tenenbaum. Named to head sub-committees on the three phases of standardization are: Clarence Tice of Delco-Remy Div., General Motors Corp.; Lee Axford, Ford Motor Co.; and Henry Erickson, Chrysler Corp.

Next meeting of the group is scheduled for March 5, 1957, in Detroit, at which time exploratory meetings of the several committees will be reported.

Emphasis was placed upon the national defense aspects of die casting machine standardization. The difficulty of moving dies from one plant to another in the event of a national emergency would present an impossible problem of adapting die casting dies, it was emphasized at the meeting.

Methods of measuring clamping pressures of die casting machines has long been a point of discussion in the die casting industry, both by die casters and machine builders. This is the principal point of comparison in rating different makes of machines, but since no standard method of arriving at these tonnages has ever been established, many industry leaders have felt that there is no dependable comparison among different machines.

The method to be studied most closely for machine clamping measurement is a system adopted by the builders of plastic injection molding machines. The close parallel in machine operation is felt by committee members to favor the introduction of this testing system for die casting machines.

Included in data to be standardized for machine platens are: size and location of clamping slots or hole patterns, knock-out hole patterns and location of the metal injection system relative to the center of the platen.

To be included in consideration for standard rating and nomenclature are: clamping tonnage, distance between tie bars, maximum and minimum shut height, location of injection sleeve, length of stroke, shot capacity (weight of shot, size of nozzle, pressure, projected area and time).

C. J. SHEEHAN NAMED PRESIDENT BY DIE CASTERS

Clifford J. Sheehan, Eastern sales manager, Die Casting Division, Aluminum Company of America, Garwood, N. J., has been named president of the American Die Casting Institute

Clifford J. Sheehan

by the Institute Board of Directors following the resignation of W. J. During.

Mr. Sheehan's die casting career with Alcoa has covered a span of over 35 years and has involved many phases of the business, including purchasing, cost accounting and sales. He has been active in Institute affairs since 1945 when he assumed his present duties at Alcoa.

Mr. Sheehan has long been a member of the Institute's Finance Committee and has participated in many activities of the Eastern Regional Group, including service as Chairman of the Membership Committee. He was elected to the Board of Directors in 1954 and to the Vice-Presidency of the Institute in September of this year.

GORDON C. CURRY ELECTED ADCI DIRECTOR

Gordon C. Curry

At a recent meeting of the Eastern Regional Group of the American Die Casting Institute, New York City, it has just been announced that Gordon C. Curry was elected a director to fill the board vacancy left by the resignation of William J. During. He will serve as a director through 1958. He is now a member of the Institute's Standards Committee and a member of the Eastern Regional Group Executive Committee.

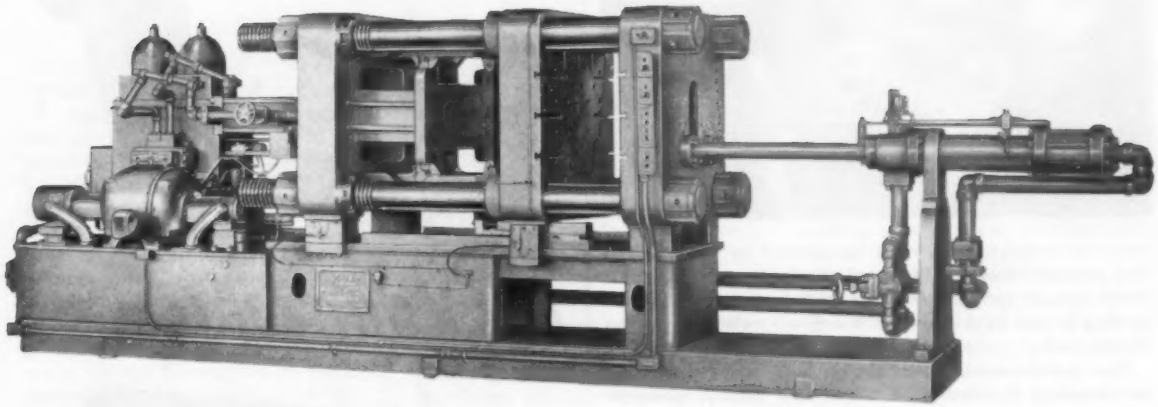
Mr. Curry is Eastern sales manager of the Precision Castings Co., division of Harsco Corp.

TWO PROMOTED BY H-P-M

E. L. Oehling has been promoted to general sales manager and R. J. Lindsey to vice president in charge of engineering, it was announced recently by W. H. Bennett, president of the Hydraulic. Press Mfg. Company.

PEMCO* die castings cut the world's lawns...and

KUX cuts Pemco's costs



THE MAMMOTH KUX HP-38

Hydraulically operated cold chamber model for the production of die castings from aluminum, brass or magnesium.

Also available in plunger gooseneck model for the production of die castings from lead, tin or zinc

Model BH-38

KUX
MACHINE COMPANY
6725 North Ridge Avenue, Chicago 26, Ill.

Builders of a full range of die casting machines... from 25 tons to 1000 tons in size.

*PEMCO, trade name of PRODUCT ENGINEERING AND MANUFACTURING CORPORATION, Bridgman, Michigan, uses many sizes of KUX Die Casting Machines to produce top quality die castings for industry.

The rotary lawn mower housing illustrated is an example of the high quality large die castings made by Pemco for leading producers of lawn mowers and other major household appliances. To make them with speed and cost-cutting efficiency, Pemco relies on the mammoth Kux HP-38, with its exceptional capacity for large dies, coupled with ease of mounting, tremendous metal injection pressures and plunger speed.

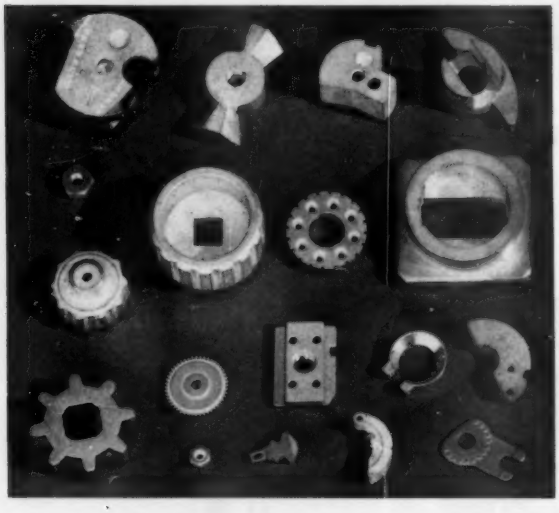
This one piece aluminum die casting measures 24″ x 24″ and weighs 15 lbs. Produced at an average speed of 60 castings per hour, with the aluminum injected into the die at a pressure of more than 5000 lbs. PSI, a die locking pressure of 750 tons is required. Thus the HP-38, having this capacity, has proven to be the ideal machine to accomplish this die casting job.

If you have a casting problem of unusual size or intricacy, come to Kux, where no die casting problem is too big or too small for our experienced engineers to solve to your advantage.

For more information circle No. 67 on the Reader Service Card

MEETING DESIGN NEEDS

Even greater savings in product costs are possible with BRASS AND NICKEL SILVER POWDERED METAL PARTS



Very substantial savings are being realized by manufacturers who have turned to powder metallurgy for structural and functional parts. In each case, use of the metal powder process was justified by cost comparison with a previous method of meeting design needs.

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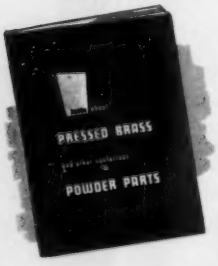

For detailed information on the design, properties, production and application of brass and other nonferrous powder parts you should have a copy of our manual. It will give you 20 case histories of brass and nickel silver powder structural parts to assist in evaluating this means of production in terms of your particular needs.

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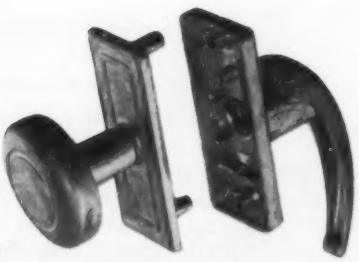

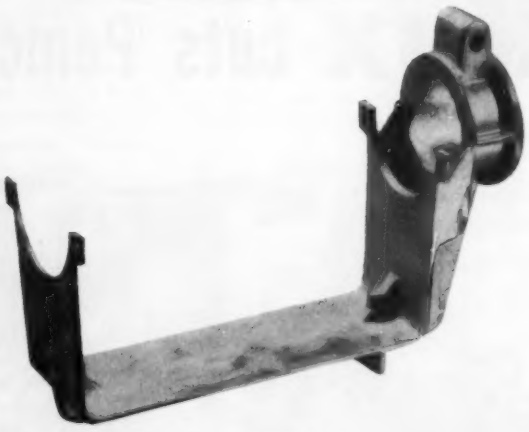

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Fire-Resistant Hydraulic Fluids For The Die Casting Industry

Part 1: Emulsion Types

By A. S. MORROW, H. E. SIPPLE, R. T. HOLMES
Technical Staff of Shell Oil Company, New York City

THE flammability of conventional petroleum hydraulic oils has always posed a safety problem for industry, one that has become more important with the increasing use of oil hydraulic power. While they have been used successfully for years as the actuating agents in hydraulic equipment (and will continue to serve well where safety is not involved) flammable fluids are a serious fire hazard in those operations where ignition of the fluid could result from possible leakage or line ruptures.

Frequent industrial fires involving flammable fluids have pointed up the need for fire resistant hydraulic fluids in potentially hazardous operations. During the past ten years, several such fluids have been introduced that can be classified in two main groups:

a) Pure synthetics having properties of fire resistance, wear protection and high bulk modulus.

b) Mixtures of water and water-soluble synthetics, i.e., "snuffer" type fluids, whereby fire resistance results through release of a protective steam blanket in the presence of high temperature.

The most recent of the fire resistant hydraulic fluids is an emulsion-type, which consists of petroleum oils mixed with water and emulsifying agents. This new "snuffer" fluid, which solves the safety problem while embodying all the desirable characteristics of petroleum hydraulic oils, has been developed by Shell research*.

Over the past three years, laboratory and field tests with this fluid have been made in a wide variety of systems including die casters, electric welders and decoilers. Over 44,000 system hours' operation have been logged with over 6,000 hours to date on two individual units. Satisfactory operation is reported in systems operated by vane and gear pumps up to 1,000 psi per stage, and 2,000 psi for piston pumps. In these tests, the fluid has demonstrated the following features:

Excellent fire resistance, acceptable lubricating properties, emulsion stability to water separation, corrosion resistance, hydraulic efficiency, high viscosity index, film strength, good system cooling, oxidation stability, equipment compatibility . . . and economy.

The last advantage is by no means least for the fluid costs up to one-third less than conventional fire resistant fluids, a major consideration not only in initial purchase price, but in reduction of expense for make-up loss.

This fluid is recommended for all hydraulic applications of 2,000 psi or less where fire hazards are prominent, including all forms of die casting, permanent mold machines, metalworking presses near heat, quenching plants, welding, actuating units, steel mills (including coke pushers), coke oven door closers, dolomite chargers, pipe coupling tighteners, combustion control mechanisms, furnace

Continued on page 134

*Trade name, Irus Fluid 902.

. . . MORE ON FIRE-RESISTANT FLUIDS

This is the first of a series of basic articles on the different hydraulic fluids currently available for use in die casting machines and presses operating in or near hazardous areas. Subsequent articles will be:

February — Aqueous Base, Fire Resistant Fluids, by W. H. Millett, Carbide and Carbon Chemicals Co.

March — Phosphate Ester Based Fire Resistant Hydraulic Fluids, by F. H. Langefeld, Monsanto Chemical Co.

April — Steps To Take When Installing Fire-Safe Hydraulic Fluids, by Charles R. Schmitt, E. F. Houghton & Co.

May — (Title to be announced), this final article will deal with the experience of a large die casting company.

lid mechanisms, plastic molding presses, glass blowing machines, and many others.

Fire Resistance

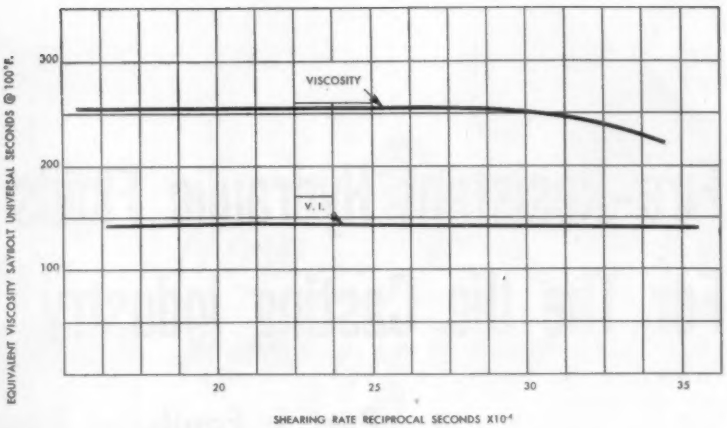
Irus Fluid 902 gains fire resistance through its relatively high water content, and will not explode or burn readily on contact with a source of ignition. When continuously exposed to a source of high temperature, the released steam blanket effectively reduces local temperatures and displaces oxygen from the immediate area. The fluids remaining after the major portion of the water has been dissipated as steam may burn with an intermittent, luminous flame, but this flame will not trail away from the immediate source of high temperature, nor will the fluid support its own combustion.

Fire resistance has been further examined in several standard flammability tests as follows:

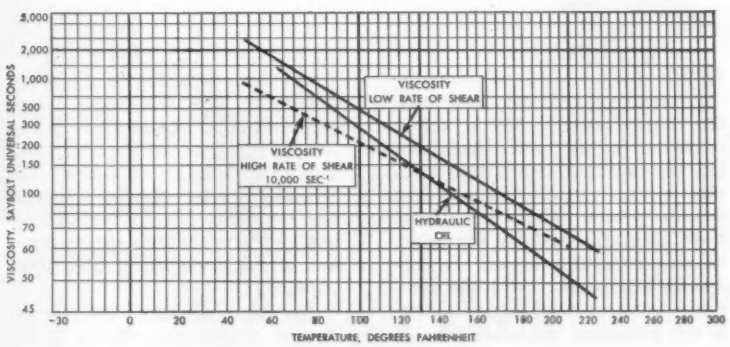
1. **High Temperature** (Pressure ignition spray test, Specification MIL-F-7100) In this test the fluid is forced through a 0.0145-inch diameter sharp-edged orifice at a pressure of 1,000 psi and a temperature of 60 to 100 F. With an oxyacetylene torch adjusted to a neutral flame, an attempt is made to ignite the fluid stream at distances up to 18 inches from the orifice. Under these conditions, the fluid cannot be ignited.

2. **Hot Manifold Test** (Specification MIL-F-7100) A sand-blasted stainless steel tube is heated to 1,300 F surface temperature by means of electrical resistance heaters. Ten milliliters of the test fluid are poured steadily on the tube in not less than 40 seconds nor more than 60 seconds. Under these conditions, the emulsion produces a few small flashes on the hot tube, but there is no continuous burning.

3. **Pipe Cleaner Test** (Modification of Specification MIL-F-7100) A 2-inch length of standard pipe cleaner is soaked in the test fluid, allowing the excess to drain off. The pipe cleaner is then passed repeatedly through a laboratory bunsen burner flame or between electrically-heated grids maintained at 1,300 F. The number of passes before continuous burning occurs is considered a relative measure of fire resistance. The following are typical results of this test:



1. SHEARING RATE vs. equivalent viscosity and viscosity index.



2. VISCOSITY-TEMPERATURE relationship for Shell Irus 902.

	Passes Before Continuous Burning
Shell Irus fluid 902	48
Conventional petroleum hydraulic oil	5

Wear Resistance and Film Strength

Laboratory tests in commercial vane pumps, operating continuously at 1,000 psi, 1,200 rpm, and 150 F, fluid temperature, have shown equal wear rates with Irus and a conventional petroleum hydraulic oil. Cyclic tests in field units, where the pump suction lines are unrestricted, have indicated wear rates equal to or only slightly greater than petroleum oil.

Film strength, which is important in providing good antiwear and antiscuff protection for closely fitted machine parts, has been determined in a special high-speed spur gear test machine at 3,600 rpm. Under the conditions of this practical wear-testing device, the emulsion-type fluid showed a measured improvement in antiscuff loading as compared with conventional mineral oil.

Other Features

1. The high specific heat and heat transfer rates of Irus resulted in lower pump operating temperatures and reduced water flow at the oil coolers.

2. The fluid's distinctive yellow odoring enable leaks and spills to be readily spotted and easily traced. Leakage and overall maintenance have been greatly improved in shops using this material. Further, this coloring immediately identifies the fluid and reduces the possibility of contamination and mixing.

OPERATIONAL CHARACTERISTICS AND PROPERTIES OF OIL EMULSION HYDRAULIC FLUIDS

TABLE 1—Typical Physical Properties of Irus Fluid 902

Specific gravity, 60/60	0.93
Weight, pounds per gallon	7.75
Color	Yellow
Neutralization No. (TBN-D)	2.5
TAN-C	0.18
Odor	Mild, pleasant
Toxicity	Compares to hydraulic oil
Specific Heat at 70 F	0.67 Btu
100 F	0.68
140 F	0.69
Coefficient of thermal expansion at 60 F	.0003
Minimum bulk fluid starting temperature (4000 SUS)	30 F

TABLE 2—Effect of Temperature Upon Emulsion Viscosity

Temperature, F	Irus Fluid 902 emulsion containing 100 S.S.U. at 100 F
S.S.U. at 40	2580
S.S.U. at 70	924
S.S.U. at 100	450
S.S.U. at 140	173
S.S.U. at 180	99.6
Viscosity Index	134

TABLE 3—Apparent Emulsion Viscosities by Modified ASTM D-1092-51

Shear Rate, Sec.-1 — 100 F	Shell Irus 902 Equivalent Viscosity Saybolt Seconds Universal
0	450
250	263
600	252
1500	234

TABLE 4—Effect on Seals (% Change in volume after immersion for one week at 160 F)

	Irus Fluid 902	Mineral Oil
Synthetic Rubber A	Minus 6.5	Minus 6.5
" " B	Minus 4.6	Minus 10
" " C	Plus 2.7	Plus 4
" " D	Plus 9.2	0
" " E	Plus 12	Plus 3
" " F	Plus 17	Minus 0.9
" " G	Plus 28	Plus 23
" " H	Plus 45	Plus 25
" " J	Plus 90	Plus 78
" " K	Plus 236	Plus 251

3. There has been no evidence of rusting or corrosion in sumps, pump components, suction screens or filter bodies in any of our field and laboratory tests. Pumps included Vickers vane and piston; Denison, Racine and Dudco vane; and Gerotor gear.

Corrosion tests conducted with non-ferrous metals suspended in fluid at 160 F for one week with stirring indicate no change in aluminum and only slight discoloration of copper, brass and magnesium. There was no pitting or metal attack in these tests.

4. The fluid's compatability with normal system components indicated that the emulsion has no more effect on packing materials, seals, and hoses than does conventional petroleum oil.

Butyl rubber, installed specifically for use with certain synthetic fluids, will probably swell in the presence of petroleum oils or Irus. However, unless operation is impaired, it is generally not necessary to replace the seals until they are disturbed during an overhaul.

5. Representative paints used in and near hydraulic systems have indicated no unusual effect due to this fluid. Wide usage of the fluid in industrial hydraulic power units has not revealed damage to any oil-resistant surface coating.

Viscosity

Since this is a non-newtonian fluid, the difference in viscosity as measured by the Saybolt Viscosimeter, and the viscosity under high shear rates by the modified ASTM D-1092-51 method is to be expected. Thus, at 100 F, the Saybolt viscosity is 450 seconds, while under shear of 10,000 sec^{-1} it is only 253 seconds. Accordingly, in the areas of a system where the fluid would be under a relatively low rate of shear, i.e., suction screens and lines, the fluid is above recommended viscosities for some pumps. Enlarging thes areas will permit satisfactory fluid flow and reduce the hazard of cavitation.

However, in the pumps, and valving where the fluid is sheared, the viscosity is within designed limits of most equipment, and excellent performance is realized without any system modifications, Figures 1 and 2.

The viscosity index, Figure 1, is a relative measure of the change in viscosity with temperature, the higher values indicating the least change. The temperature viscosity

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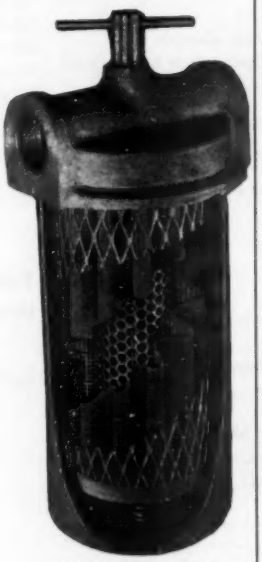

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relationship of this fluid has been calculated in the customary way from low shear rate viscosities, and also from viscosities, measured at shear rates up to 200,000 reciprocal seconds. It was found to be much greater than ordinarily obtained with petroleum oils. This favorable viscosity-temperature relationship indicates maximum hydraulic efficiency and minimum difficulty in operating over a wide range of temperatures.

Preparation Of Hydraulic Systems

The preparation of hydraulic systems for the use of Irus consists primarily of cleaning, a procedure no more involved than if a charge of petroleum oil was to be introduced in the system. Although the fluid is completely compatible with conventional petroleum hydraulic oils, mixing with these materials will reduce the fluid's fire resistance and cause possible contamination. To obtain optimum service from an emulsion-type fluid, it is excellent practice to clean any system and keep it clean. Systems to be converted may be one of the following types:

a) New or clean system using conventional petroleum hydraulic oils and not containing rust preventive compounds.

b) New systems containing rust preventive compounds or oils, or systems contaminated with oil deterioration products.

c) Systems containing either synthetic or water soluble synthetic mixtures of fire-resistant hydraulic fluids.

Cleaning Procedures The preceding fluid in the machine should be drained completely, blowing down lines and accumulators, separating fittings at low spots and hand wiping sumps to assure a clean system. System cleanliness is necessary to assure maximum performance of close-fitting pumps, valves and pressure control devices.

a) New or clean systems should be carefully drained and a charge of premium hydraulic oil or Irus circulated during at least one working day to displace old oil from inaccessible parts of the system. Following draining of the unit, the system should then be filled with a second operating charge of Irus.

b) New systems containing rust-preventive compounds or oil, etc. These materials should be removed thoroughly from sumps

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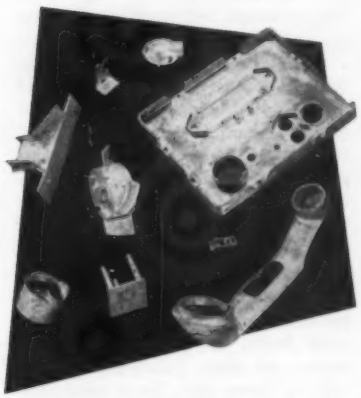

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and accessible points by hand wiping. The system should then be cleaned by circulating a turbine cleaner at the minimum operating pressure.

After all components have been operated to allow complete flushing, this cleaner should be carefully drained when the normal fluid operating temperature is reached. Follow this with a mineral oil flush and then displace any remaining oil with an Irus fluid flush. It is avisable to operate the unit during a normal working day on each of these flushing charges. An inspection of the sumps following each charge should be made. Finally, fill the system with a complete charge of the new fluid.

c) The presently available synthetic and water-base fire-resistant fluids will affect the stability and performance of the emulsion-type fluid. Therefore, it is important that the synthetics be *completely* removed from the system. Laboratory and field tests have indicated that this can be easily accomplished by the following procedures.

The synthetic fluid should be drained as completely as possible, including draining cylinders and

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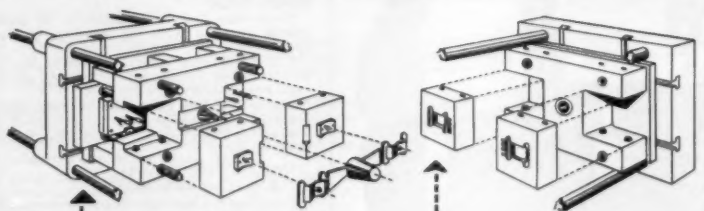
accumulators, separating lines at low spots and hand-wiping the sumps. The system should then be flushed completely with two mineral oil flushes, followed by a flush with Irus before the final charge. Operate the system during a normal day on each flushing charge, and carefully drain the system while the flushing material is still warm.

In addition, systems currently operating on synthetic fluid should be considered with respect to any modifications in special components, such as seals, hoses, paints, etc., which have been installed specifically for use with these fluids.

During the flushing operations, and for a period thereafter, the suction screens and filters should be checked periodically to prevent build-up of deposits. Because of the fluid's cleansing action, there will be a tendency to remove and suspend sludges and deposits not completely removed during the cleaning.

It is recommended that light solvents or chemical cleaners not be used in connection with this fluid because of their effect on fluid stability, and possible reduction in fire resistance.



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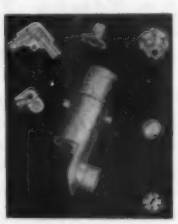

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Suction Screens Owing to an unusual characteristic of emulsion-type materials, (as discussed under viscosity) this fluid appears to have two different viscosities. This phenomenon affects the use of the fluid only in requiring an increase in the capacity of the suction system.

Normally, hydraulic power systems are equipped with 100 mesh suction strainers having capacities (measured in terms of 225 SSU at 100 F petroleum oil at 100 F) equal to about 1½ times the rated pump capacities. As a result of the higher low-shear viscosity of Irus excessive pressure drop would occur across screens of this capacity with resultant pump cavitation and serious damage. *In all systems, it is absolutely necessary that suction line restrictions be reduced to allow adequate flow of the fluid to the pump under all operating conditions.*

This condition resulting in cavitation can be detected by installing a vacuum gauge in the suction line immediately ahead of the pump. Typical recommendations by pump manufacturers are a maximum permissible vacuum at the pump inlet of 5 psi (10

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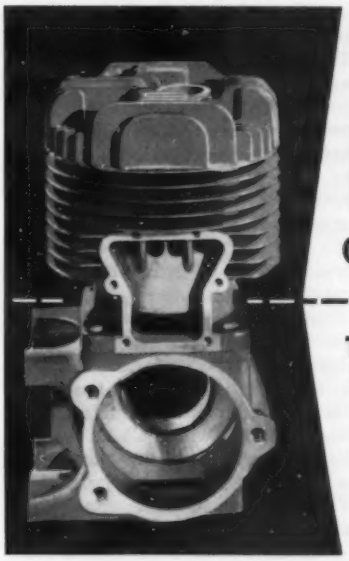

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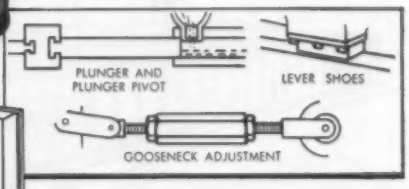

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JOHN CRANE CRANE PACKING COMPANY

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inches of mercury) for vane-type pumps and 7.5 psi (15 inches of mercury) for gear-type pumps.

Tests have indicated that conversion to *50-60 mesh* screens having more than *4 times* the rated pump capacity will provide unrestricted flow. Suction screens have been completely removed from many of the hydraulic power units presently using this fluid, with satisfactory results.

Providing the pressure side of the system with non-absorptive filters such as 200-300 mesh wire screens and edge-plate or knife-edge types will insure minimum solids contamination. Absorptive filters such as the clay, cotton, felt, paper or resin-impregnated types may remove certain fluid components that would adversely affect the product's stability and are definitely *not* recommended.

Maintenance With "Snuffer" Type Fluids

Good preventive maintenance of hydraulic systems pays dividends in terms of greater efficiency and reduction of losses due to leakage of fluid, damage to equipment or machine-down time. System components should be checked periodically and replaced before failure or damage results. The tight closure of the system and an adequate filter on the breather prevents the entrance of outside solid contaminants.

Continuous or periodic filtering of the hydraulic fluid is recommended to remove solids entering the system by various routes. Where different fluids are used in the same shop, the fluid on each machine should be positively identified through a marker on the fill pipe.

1) The fire resistance of emulsion-type fluid is obtained through the inclusion of a large percentage of water which is held tightly in the fluid until it is exposed to higher temperatures. Thus, it is important that fluid temperature not exceed 150 F in order to hold to a minimum loss of water through evaporation. In general, manufacturers of hydraulic pumps and components suggest an average operating temperature of 120 F for any fluid.

2) It is advisable to take every precaution in using water-containing fluids in the proximity of molten magnesium.

3) Emulsion-type fluids will tend to separate a small amount of oil on the surface after long-

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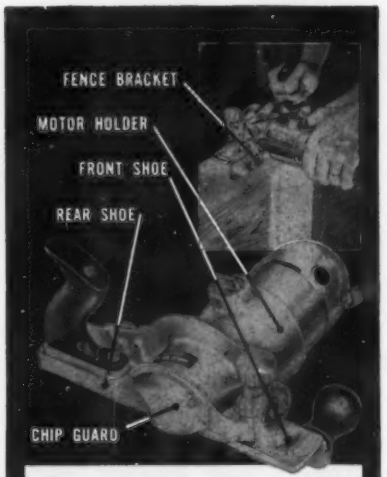

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term storage, particularly in a warm climate. This oil will readily remix when agitated and *drums should be agitated* before withdrawing small amounts for make-up purposes. Although the water will not normally separate from the fluid, water separation due to evaporation and condensation in an operating unit will be readily re-emulsified in the fluid by the dispersing action of the pump.

4) Emulsion instability or water separation may occur as a result of contamination of the fluid with certain chemical cleaners, solvents and synthetic hydraulic fluids, or after an extended period of severe usage. These conditions may be detected by placing a representative sample of the fluid in a clean 4 oz bottle and allowing it to stand at room temperature. Separation of free water within a few hours is an indication of poor emulsion stability and the fluid should be replaced.

5) In comparison with premium hydraulic oils wherein the neutralization number (Acid) TAN may rise during service, this material has a high neutralization number (Basic) TBN initially, and will gradually decrease in

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service. A minimum TBN value of 1.25 to 1.50 is recommended.

Emulsion Separation To Determine Water Content

Sampling — a representative sample of the fluid should be drawn from the system for analysis while the unit is operating at normal fluid temperatures. Withdraw several times the volume held in the drain or sample line and return to the system before removing the sample for analysis.

Water may be separated from the fluid by the following procedure:

1) Fill a stoppered 100 ml glass graduate to the 50 ml mark with the sample fluid.

2) Add to this, 50 ml of commercial pent acetate and shake to mix thoroughly.

3) Allow to stand until the water and oil are cleanly separated. The complete separation is effected when the oil phase no longer contains a water haze.

4) Measure the water content directly, subtract 2 percent to allow for the solubility of the solvent in water, and double the

Here are a few hints on the application of emulsion-type fluid that will be of assistance to the hydraulics engineer:

1. System should be thoroughly cleaned.
2. Contaminants should be continually removed from the fluid by use of the proper filters . . . such as metal screens or edge-type filters.
3. Maintain proper suction lines to prevent cavitation.
4. Operating temperatures should be 50 F to 150 F.
5. Do not exceed 1,500-2,000 psi pump pressure. The manufactures' recommendations should be followed.
6. Agitate drums of the fluid thoroughly before drawing off any quantity.
7. If a system has been shutdown for prolonged periods, check fluid for separation and if necessary, mechanically mix before starting pumps.
8. Periodically check for free water; loss or gain of water.
9. Occasionally check neutralization number if facilities are available.
10. Do not permit admixing of fire-resistant fluids.

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final figure for the volumetric percentage water content.

There may be a third, dark phase existing as an interfacial layer and consisting of suspended contaminants and water (indicating the fluid should be filtered). If so, measure to the center of this phase in determining water content. If the corrected water content fails below 32%v, additional distilled water should be added slowly to the sump while the unit is in operation, raising the water content to 37%v.

If the water content is increased beyond 42%v through leakage at the oil cooler or other source, the fluid should be drained and replaced. It will be noticed that the viscosity of the fluid increases rapidly as the water content exceeds 42%v.

In the event that the pent acetate is not available, ethyl ether can be substituted directly by eliminating the 2% correction for solubility. If the emulsion does not separate readily by either method, add 1 ml of concentrated hydrochloric acid remix, and make the determination.

NEW PRODUCTS

continued from page 129

PIGGY BACK STAND . . . positions tumblers

Easy unloading into a screen separator is provided by a piggy back stand which supports tumblers above the screen.

The stand can be used either left or right hand, or two stands can be used to position two tumblers into the same separator.

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AUTOMATIC BENCH VISE . . . saves time, motion

An air hydraulic vise has been designed for jobs that require frequent clamping and unclamping. This vise is claimed to open and close up to 2,000 times per hour at the touch of a foot pedal air control.

Maximum locking force varies between 2,513 lbs. and 6891 lbs., depending on the size of the vise. Locking force can be reduced to prevent damage to soft work.

Wilton Tool Mfg. Co., Inc.
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Continued on page 144

Type ID, 20-lb., 20-kw. Detroit Furnace with phantom investment mold attached.

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With these two new Detroit Investment Casting Furnaces, precision parts of uniform high quality can be cast quickly, economically. Fast indirect arc melting maintains close metal analysis through heat after heat. When a melt is ready, the mold is clamped on and the furnace is inverted for pouring. Direct furnace-to-mold casting reduces handling and cuts the melting cycle to only minutes for parts up to 20 pounds.

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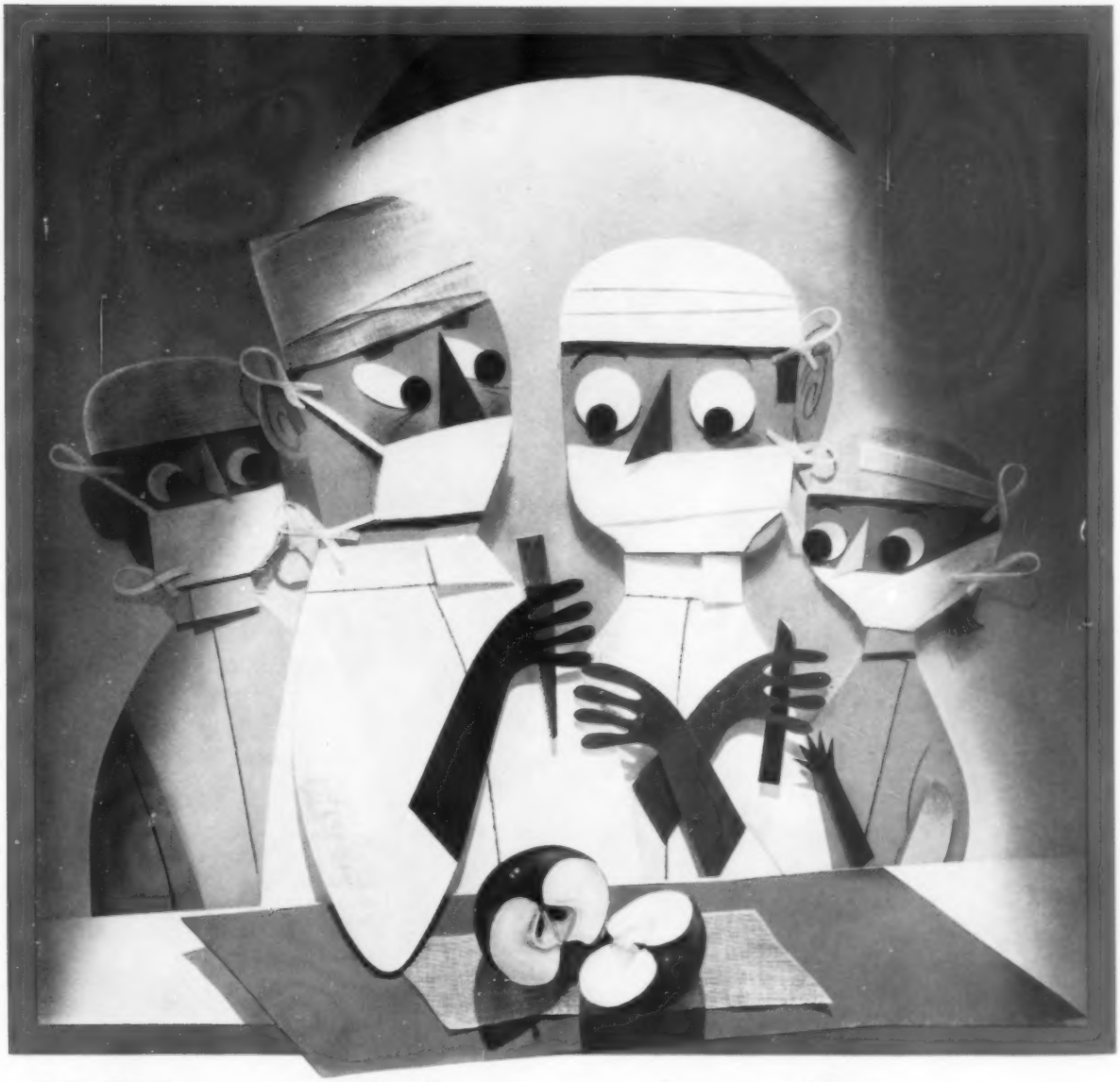

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